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THE UNITED ENGINEERING BUILDING.

The steady progress made in matters connected with the United Engineering Building is a cause for hearty and general congratulation among engineers. The plans accepted and soon to be published are understood to insure a structure that will not only be a worthy addition to the architectural ornaments of New York City, but an invaluable addition to the resources and facilities of the national bodies it will house. As an engineering center nothing can compare with it in the world, and that is all the more reason why the building should be not merely a nest of offices and an assemblage of bare auditoriums, but a place which by its literary, artistic, historic and decorative features will appeal to the pride and esprit de corps of every engineer enrolled in the societies charged with the responsibility of administering Mr. Carnegie's gift.

It is here, in this matter of administration, that the serious work must now be done. The preliminaries have all been attended to and cleared away, and the electrical, mechanical and mining institutions primarily interested must now see to it that their individual shares of the task are discharged. Money has to be raised for purchase of the land, each society must be put in position to do its duty and assume its part of the scheme, and various legal, executive and financial problems must all be faced and disposed of in the same large spirit as that which evolved the original benefaction. We believe and are convinced that in no respect will the societies be found wanting, but that at this very moment they are preparing for the next important stages that will carry the whole splendid project to fruition.

TROLLEYS AND TRUNK ROADS.

The United States Census Bureau has issued recently some very interesting and suggestive figures in its report on occupations in 1880 and 1890. The most notable gains are those exhibited in the electrical field and particularly in the industry of traction. Thus electrical engineering, with other engineering branches, increased over 1,037 per cent. in the twenty years, while doctors of medicine increased only 55.30 per cent. and lawyers 78.63. In like manner, while steam railway employees increased 146.61 per cent, street railway employees increased 520.90. The general increase in trade and transportation was 154.79 per cent., and in mechanical and manufacturing pursuits 89.20 per cent.

We have here another indication of the manner in which electric traction has come to the front, enlisting the best engineering talent and giving occupation in remarkable degree to labor and capital. It is hardly likely, however, that, great as the strides have been in the past twenty years, they will be any less in the next ten, a period which will see the steam locomotive disappear as utterly from New York and other large cities as though it were a mastodon or ichthyosaurus. Moreover, the recent purchases and acquisitions of trolley systems outside the big cities by various trunk roads are a further evidence of an intention to control and develop short-haul traffic wholly by electrical methods. In this connection we note a very broad-minded and liberal view of the situation advanced by the New York *Tribune*, which says of the New York Central: "It might, and we expect will, with a large intelligence, use the new system to extend to various communities all the facilities which electricity makes easy. In the end this will be to the railroad's

advantage. As a canal, instead of injuring a parallel railroad by its cheap rate for raw materials, develops industries and makes more business for the railroad, so the trolley, instead of being a rival, is really a supplement to the railroad. It gives to a community with the greatest economy a service which develops it and makes business of the sort which the railroad can most economically handle. All methods of transit work together."

There can be no denial of the fact that the infrequent service and high rates of fare that have gone invariably with steam conditions are now destined to depart forever under the electric régime, the history of the Manhattan Elevated being repeated with equal success by every railroad company that has the courage and enterprise to undertake the experiment. The larger the steam system, the longer electricity may be held off as an expensive change, but both the New York Central and the Pennsylvania have determined on the innovation, and we see the beginning at their ends. Such ready adaptation to the spirit of the times will be well repaid. The means and methods adopted may be different in each case—third rail here, overhead trolley there—but the ultimate results will be the same. In fact the variety of resources is greater to-day than it ever was, so that in the new work to be done innovations and advances of an even startling nature are to be expected.

ELECTRICITY AND GRAVITY.

It is a fact, no less remarkable because appreciated by all, that since the apple-tree episode little has been added to our knowledge concerning the nature of gravity. How large the force is can be determined, what effect it produces can be ascertained, but what it is is not known, in spite of the enormous amount of labor which has been spent upon the problem. The trend of the modern investigation of such long outstanding problems is indicated in the article by Sir Oliver Lodge quoted on page 164 of this issue. That gravitation in its various phenomena is closely allied to certain of the extraordinary properties of electricity has long been held. The author of the article mentioned brings forward incidentally a theory of his own which would closely connect electricity with gravity, without, however, attempting to explain the exact nature of either.

Another interesting feature of the statement by Sir Oliver Lodge is embodied in his treatment of the relation of electricity to energy. The comparison of water to electricity, in view of the most recent study as to the nature of the latter, seems almost like returning to first principles. The article is written in popular style, and, as giving a condensed statement of the latest scientific guesses concerning the unknown, its reading should prove interesting and instructive, for it serves as a stimulus to thought, even if it adds little to the knowledge of fact.

AN INTERESTING ENGLISH STATION.

The power station at Sheffield, England, a description of which is given in this issue, embodies in its equipment no new features of interest, but the selection of machinery and system reveals certain points which tend to differentiate the practice from what seems to have become standard in this country. For the conditions there existing it would appear that the two-phase system was better adapted than the three-phase. To an extent which cannot be considered true of three-phase generators, two-phase alternators operate as though composed of single-phase machines synchronously driven by the same prime-mover. A variation in the non-inductive load on one phase has almost no effect upon the e.m.f. generated in the other, whether the phase windings be isolated or interconnected. In the installation at Sheffield each of the two separate feeder circuits from the generator is independently regulated by means of series booster transformers, while the station e.m.f. is maintained at any desired value, the result thereby obtained being somewhat more satisfactory than what is found to exist when polyphase induction regulators are used on three-phase systems. In changing an existing single-phase distributing network to one suitable for polyphase operation, the task is considerably simplified if the circuits can be divided into two parts and retained isolated as though supplied from two generators, rather than divided into three parts and variously interconnected in order to obtain the 25 per cent. economy in conducting material—an economy in many cases more imaginary than real.

The frequency chosen seems to have been given a compromise value. It is somewhat unfortunate that incandescent and especially arc lamps require a periodicity so much in excess of that which gives best operation of electrical machinery and transmission circuits. The Sheffield installation furnishes an example of the numerous instances when a frequency of 45 to 50 for all purposes is preferable to a combination of 25 for generation, transmission and power purposes with 60 obtained by motor generators or frequency converters for distribution to lighting circuits. Until some of the recently exploited lamps of the electrochemical or similar type or some illuminating system not yet discovered or exploited be proved to be approximately as satisfactory as the incandescent lamp with its wonderful simplicity, the choice of frequency for mixed service must remain subject to variation; and standardization in this detail cannot be considered final before that time.

BRANCH MEETINGS AND LOCAL ORGANIZATIONS.

The report of the Committee on Local Organizations recently presented to, and printed by, the American Institute of Electrical Engineers, shows that there are 29 branches of the Institute, in as many different cities. The average total attendance at these branches is stated to be over 1,300; while the attendance at the New York meetings of the central organization is not over 200. Consequently, through its branches, the Institute increases its attendance at meetings, for the consideration and discussion of papers, more than sixfold. Expressed in another way, the total attendance at Institute meetings is increased by the branches from 6 per cent. of the total membership to nearly 50 per cent. In the eighteen months following October, 1902, the number of original papers contributed to the branch meetings was 80, or, on the average, nearly 3 per branch.

There can be no question of the great value of these branch meetings; not only to the Institute members, but also to the Institute. The members remote from New York are enabled to hear the papers read and discussed, as well as to meet each other in a sociable, and, at the same time, technically stimulating manner. The Institute gains by numbers, and by resources for good contributions to its papers. So long as the sectional movement does not disturb the federal relation, whereby the management of affairs as a body is entrusted to the central organization in New York as a working unit, the local branch plan should prove a beneficent influence. The active co-operation of all the various branches is only capable of being rendered effective by maintaining a central unity of administration. So far as can at present be foreseen, this federal policy will persist, with the best results for the welfare of the electrical industry, not only in America, but also over the whole world. There are many problems connected with the maintenance of local branches, chief among which is that of keeping up the enthusiasm and interest. That done, other difficulties are lessened.

NATIONAL FIRE PROTECTION ASSOCIATION.

In view of the fact that there was a time within the memory of all now connected with electrical engineering when the causes for fires from any origin whatsoever were indiscriminately attributed to defective electric wiring, wherever a single electric circuit could be found in the neighborhood of the fire, the last annual report of the proceedings of the National Fire Protection Association contains some interesting, cheering and instructive statistics. Of 386 fires included in a certain report, only one is attributed to defective electric wiring, while to electrical causes of all kinds only 10 fires have been due; spontaneous ignition, however, is accused of causing 49 fires. The statistics given show a remarkable efficacy of automatic sprinklers, the sprinklers having handled successfully 512 fires of the 561 reported under sprinkler risks during the past year. That is, the fire was either extinguished by the sprinklers or was properly held in check so as to allow of easy extinction by such outside aid as was at hand. The percentage of sprinkler alarm failures is remarkably small (6 per cent.).

Thermostatic alarm devices, however, seem not to have given marked satisfaction, having proved failures for 37 per cent. of the fires. In many cases the sprinklers operated first, thus cooling the thermostats and preventing their fusing. In only 5 per cent. of the fires did the thermostats give the initial alarm. In practice the thermostats have shown lack of reliability by giving false alarms. A further trouble with such devices appears due to the fact that if the ordinary wire is cut nothing happens and nobody bothers to rectify a defect which is not detected. The present state of the development of thermostatic devices may be ascertained from the report of the Committee on Signaling Systems, that while an installation of a high-fusing point thermostatic wire might sometimes be the means of detecting a fire, the committee did not feel that it was expedient for the association to undertake to formulate any standards for the construction or installation of such a device. Complete specifications are given in the report volume for the installation and operation of electrically driven fire pumps, among which may be noted the requirements that the lowering transformers for an alternating-current driving motor shall be used exclusively for this purpose, and must be connected without fuses in the primaries or secondaries; and that the protective devices on the circuits at the source of power must be of such capacity that they will not open except from short-circuit on the mains and feeders.

THE ABSORPTION OF ENERGY IN CONDENSERS.

In the transmission of alternating currents at high pressures over considerable distances through underground cables, a large aggregate amount of insulating material is necessarily stressed electrically to and fro many times per second. Air, as a dielectric medium, seems to be completely elastic and not to absorb any appreciable amount of power in cyclic electrization; but every solid insulator yet tried has relatively imperfect elasticity, and absorbs a certain amount of electric energy at each cycle, which is dissipated as heat. The energy expended by dielectric hysteresis in an extensive network of alternating-current cable feeders may be comparable in amount with that dissipated by magnetic hysteresis in the iron cores of the transformers connected to these feeders. Consequently, the dielectric hysteresis of insulating materials which carry electric waves may be as much a matter for consideration by the central station manager as the magnetic hysteresis of steels which carry magnetic waves in transformers.

In the last number of the *Physical Review* appears a paper by Prof. Earhart upon the absorption of energy in condensers. The amount of power which a good condenser, of say one microfarad, absorbs under 100 volts pressure at ordinary commercial frequencies, is very small. This is only another way of saying that the power factor of a good condenser connected to an ordinary incandescent lighting pair of mains is very small. At a frequency of 60 periods, the alternating-current strength flowing in the condenser would be about 40 milliamperes. This current would represent an apparent power of about 5 watts; but the power factor would be so small that the actual power dissipated in the condenser would be only a small fraction of a watt. In ordinary language, the current in the condenser would be very nearly a "wattless" current. Very small power factors are difficult to measure correctly. As ordinarily measured, a small error in observation, or in the calibration of the instruments employed, may produce a relatively large proportion of error in the power factor deduced. Prof. Earhart measured the power factor of a condenser of waxed paper composition constructed for withstanding a kilovolt. He employed for this purpose the Rayleigh phasemeter. This instrument is a double-coil, alternating-current galvanometer, employing a little soft-iron wire at the axis, as the suspended system. The deflection of the wire is observed by mirror and scale, when alternating currents traverse the coils. The two coils are connected like those of a wattmeter, and the readings are carefully observed when one of the coils is reversed at successive intervals.

In the case considered, the phase difference between the current in the condenser and the 100-volt pressure in the mains was found to average 89° 32′, or about half a degree from the completely wattless condition of zero power factor. It is shown that this is equivalent to a resistance in circuit with the condenser of approximately 20 ohms, so that a 1-microfarad condenser of this type behaves like a pure capacity devoid of hysteresis, in circuit with an external resistance of 20 ohms. The charging current of the condenser would dissipate energy in the resistance coil to the same extent as the actual condenser dissipates energy hysteretically in its dielectric. The time constant of a condenser may be defined as the product of its capacity in farads and its equivalent hysteretic resistance in ohms. According to this definition, the time constant of the condenser described in the paper was in the neighborhood of 20 microseconds. This time constant would not be altered if the capacity were changed by connecting any number of such condensers in parallel. It is not stated how this hysteretic resistance varied in the condenser with the impressed voltage; but such an investigation would make an interesting research.

The more nearly perfect the condenser, and the lower its hysteresis, the smaller would be its natural time constant. The degree of imperfection of a condenser, from a hysteretic standpoint, might be expressed in terms of the time constant. The more microseconds, the more hysteresis. On the other hand, the time constant of a reactance coil, defined as the ratio of its inductance to its resistance, ought to be made as large as possible, in order that the coil may be effective reactively. In a coil with no iron core the time constant is known to be independent of the size of wire in the winding, so long as the defined winding space contains the same mass of copper; that is, as long as the ratio of insulation space to copper space remains the same. There is no difficulty in producing a coil, with air core, having a time constant of the one-hundredth of a second, or 10,000 microseconds; but it is impossible to produce a time constant of more than a few hundredths of a second, unless an iron core is used. While, therefore, the constructive value of a condenser as regards freedom from energy waste depends upon the smallness of its time constant, the constructive value of an air-cored coil, considered as a reactance, depends upon the largeness of its time constant.

Sir Oliver Lodge on Electricity.

Sir Oliver Lodge, F.R.S., contributes to *Harper's Magazine* for August an interesting popular article on the latest theories and speculations as to the nature of electricity. It may be quoted as the latest exposition of his views:

"Electricity is not a form of energy any more than water is a form of energy. Water may be a vehicle of energy when at a high level or in motion; so may electricity. Electricity cannot be manufactured, as heat can; it can only be moved from place to place, like water; and its energy must be in the form of motion or of strain. Electricity under strain constitutes 'charge'; electricity in locomotion constitutes a current and magnetism; electricity in vibration constitutes light. What electricity itself is we do not know, but it may perhaps be a form or aspect of matter. So have taught for thirty years the disciples of Clerk-Maxwell. Now we can go one step farther and say matter is composed of electricity, and of nothing else—a thesis which I wish to explain and partially justify.

"First we must ask what is positive electricity, and the answer is still we do not know. For myself I do not even guess—beyond supposing it to be a mode of manifestation, or a differentiated portion, of the continuous and all-pervading ether. It seems to exist in lumps the size of the atoms of matter; and no portion of it less in bulk than an atom has ever been isolated, nor appears likely to be isolated.

"But concerning negative electricity we know a great deal more. This exists in excessively minute particles, sometimes called electrons and sometimes called corpuscles; these are thrown off the negatively charged terminal in a vacuum tube, and they fly with tremendous speed till they strike something. When they strike they can propel as well as heat the target, and they can likewise make it emit a phosphorescent glow, especially if it be made of glass or precious stones. If the target is a very massive metal like platinum, the sudden stoppage of the flying electrons which encounter it causes the production of the ethereal pulses, known as X-rays. Electrons are not very easy to stop, however, and a fair proportion of them can penetrate not only wood and paper, but sheets of such metals as aluminum and other moderately thin obstacles. That is because they are extremely small—must smaller than the atoms of matter.

"Each electron has a definite charge of electricity, viz., the same charge as is conveyed by each single atom when a current is passed through a chemically conducting liquid. Every electron has also a definite and uniform mass, which is about 1/800 of that of an atom of hydrogen—hitherto the lightest known form of matter.

"From every kind of material the same and no other kind of electron can be obtained, and we have reason for asserting that no other kind exists.

"Electric currents are always due to the locomotion of these little electric charges; they permeate and make their way through metals, being handed on from one atom to the next, as a fire bucket is passed from hand to hand. This is metallic conduction. Liquid conduction is different; the electrons travel with the atoms in liquids, and hence travel slowly, being jostled by the crowd, and being laden with the heavy atom which they convey or propel, as a pony (or a flea—in mass a pony, but in bulk a flea) might drag a heavy wagon through crowded streets, until at the terminal station it is unharnessed and allowed to trot into its stable, which is what happens when the boundary between liquid and metallic conductors is reached. Electrons become still more emancipated, however, in rarefied gases, which act as a cleared racecourse, or like a free range for flight; and then it is possible to find them flying at prodigious speed, even as high as 100,000 miles a second, and sometimes faster still, but never quite so fast as light.

"Whenever an electron is suddenly started or stopped or made to turn a corner it disturbs the ether through which it had been quietly moving and excites a ripple in it. These ethereal ripples constitute radiation, and the best-known variety of them we call 'light.' With this we have been familiar for a long time, because of our happening to possess eyes—instruments for the ready appreciation of ethereal ripples. We used not to know the reason, however, for the production of light. We know now that it is due to the sudden change of motion, either in speed or direction, of an electron, and probably to no other cause.

"The charge in an electron is very small, but is extremely concentrated—that is to say, it exists only as a very minute nucleus; and in order to explain the manifestation of the observed mass of 1/800 part of a hydrogen atom by so trifling a quantity of electricity it is necessary to suppose that it is concentrated into a space one-hundred-thousandth of the diameter of a material atom. This is the size which is at present accepted for an electron. It is quite the smallest thing known.

"Matter, then, appears to be composed of positive and negative electricity, and nothing else. All its newly discovered as well as all its long-known properties, can thus be explained—even the long-standing puzzle of 'cohesion' shows signs of giving way. The only outstanding still-intractable physical property is 'gravitation,' and no satisfactory theory of the nature of gravitation has been so far forthcoming. I doubt, however, if it is far away. It would seem to be a slight but quite uniform secondary or residual effect due to the immersion of a negative electron in a positive atmosphere."

Right to Telephone Service.

Note has already been made of the effort to enforce telephone service made by the news systems, against which raids were directed recently by the police of New York City. The efforts in question are those of the New York & New Jersey Distributing & Circulating Company to compel the New York Telephone Company by mandamus to restore to it a full telephone service, so that it may continue to disseminate sporting and other news to its clients, who are declared by the police to be mainly poolroom proprietors. This position is not favored by Supreme Court Justice Scott, who said in a decision last week that the plaintiff's proper remedy was in an action at law for breach of contract.

The distributing company's offices in the Park Row Building were raided by the police about two months ago and some sixty telephones were torn out of the premises without any professed warrant of law. The telephone company has persistently refused to restore the service, holding that, according to its belief and information, the distributing company wanted to prosecute an illegal business, namely the furnishing of race news to poolrooms. The concern then applied to the courts for its mandamus. Mr. Limburger, counsel for the distributing agency, expatiated at length on the injustice that was being done to his client by the telephone company. He maintained that the distributing company was not engaged in an illegal business or violating any law. When he attempted to denounce the action of the police officers in raiding the place, Justice Scott interrupted him to observe that those facts were immaterial, as the only thing before the court was whether or not the distributing company was entitled to a mandamus to compel the telephone company to perform a contract.

John H. Cahill, counsel for the telephone company, declared that his client rested absolutely on the affidavits submitted by various officials that the distributing company was engaged in an unlawful business.

The distributing company has since decided to withdraw its application for an injunction and to bring action against the telephone company for breach of contract.

New Third Rail Work.

It was announced this week that the St. Clair Tunnel Company, of Port Huron, Mich., had decided to abolish the use of steam power and adopt electricity for moving trains through the Grand Trunk tunnel under the St. Clair River. A three-rail system will be put in at an expense of $400,000.

The New York Aldermen have granted, by a vote of 62 to 8, a franchise in the Bronx Borough to the New York, Westchester & Boston Railway. The Westchester railroad is to be operated by electricity throughout its length, the third-rail system being used. There will be four tracks, two for local and two for express traffic. It is planned that the local trains shall maintain a speed of forty-five miles an hour, while the express trains will attain sixty miles an hour. The company will operate a train schedule on the main line during the rush hours, morning and evening, on a headway of five minutes, and during other times of the day the headway will be sufficient to accommodate all traffic. Work is to be taken up immediately under Mr. John Bogart, the engineer.

Two-Phase Turbo-Generator Station at Sheffield, England.

THE oldest electrical supply system in the United Kingdom, which is located at Sheffield, has been undergoing for several years the changes characteristic of the development of electrical engineering. The old single-phase system has gradually been converted to two-phase, the generators at the old station have been rewound for two-phase supply, and a new two-phase station, using turbines as prime-movers, was formally opened by the mayor of Sheffield on June 27.

The site chosen at Neepsend is about two miles from the center of the city, and is an ideal one from the point of view of coal and water supply. It is situated upon the bank of the Don at a point above the town where a sufficiency of clear water can be obtained for condensing purposes, and near the Great Central Railroad, where fuel may be handled with the minimum expense. In fact, the tracks are so close and convenient that a high retaining wall had to be built against the railroad siding, as seen in Fig. 1.

The steam generating equipment at present includes two Sterling boilers, each with an evaporative capacity of 30,000 pounds per hour. These boilers are of the standard water tube type, having three steam drums and two mud drums, and are fired by means of Bennis quadruple machine stokers, using induced draught supplied by compressed air.

In the engine room (Fig. 2) there are two Parsons turbines, each of 1,500-kw capacity, and designed for steam with 150° of superheat. These are run at 1,500 r.p.m., and are directly connected through flexible couplings to the two-phase alternators. The alternators are four-polar, and have fixed magnets and revolving armature, supplying current at from 2,100 to 2,200 volts and 50 cycles per second. Each set has its own surface condenser in the basement. The circulating and air pumps are motor-driven, the speed of the motors being regulated in all cases by resistances in the rotor circuits. A 30-hp motor is provided for each circulating pump, and a 11-hp motor for each of the air pumps.

Tests of the turbo-generators were made at the factory last November, the results being shown in the table following.

Oil coolers are erected in the basement below the turbos, through which the lubricating oil is passed, and cooled by means of a cold water circulation. This water is obtained from the condensers, and, after passing through the coolers, is led into the circulating discharge pipe. For use in event of the plants running on atmosphere at any time, a pipe from the town's main is also connected to these coolers.

A British Thomson-Houston high-tension switchboard is placed on a high gallery at the left-hand end of the engine room, as seen in Fig. 2. The instrument transformers and the oil switches are at the back of the switchboard, only the handles and the release coils of the switches being on the front. Above the board and out of reach are the isolating switches. In the basement at the same end of the engine room as the switchboard there is a sub-station for the station lighting at 100 volts, and the motors driving the auxiliaries at 200 volts, and a battery is to be provided (charged by a motor-generator) on to which the chief station lighting circuits can be switched in the event of a breakdown of the generating plant.

1,500-K.W. TURBO-GENERATOR. 1,500 R.P.M.

Per cent. of full load.	Pressure lbs per sq. in.	Superheat deg. F.	Vacuum in inches.	Load in K.W.	Steam used per hour	
					Lbs.	Lbs. per kw.
00.0	148.7	38.4	28.57	.....	2,878.0	....
33.3	145.0	110.0	28.14	529.9	11,453.0	21.58
66.7	131.0	123.6	27.52	1,070.9	19,591.5	18.24
100.0	128.5	125.3	26.76	1,584.6	27,855.0	17.61

Average drop in volts from no load to full load, 3.15 per cent.
Average full load excitation, about 0.5 per cent.

FIG. 1.—GENERAL VIEW OF NEEPSEND STATION.

From the Neepsend plant to the old Sheaf Street station in the city, two trunk feeders have been laid, consisting of two pairs of 0.5-sq.-in. concentric cables insulated with "diatrine paper" and lead-covered. The cables have been tested to 10,000 volts for 15 minutes between the conductors, and 5,000 volts between the outer and lead. Sample lengths were then bent six times in alternate directions around a drum twelve times the diameter of the cable, and successfully withstood 20,000 volts afterward.

Owing to the bus-bar volts being varied with the load in the station, it is necessary, in order to keep the pressure constant at the distributing centers of the city, to feed the local transformers through variable boosters by means of which the working voltage at the station can be kept at 200. These transformers are wound in sections and connected up to multiple contact switches, which are interlocked with reversing switches in the shunt winding. By manipulating these a boost of 150 volts in 15 steps can be made either up or down on the primary transformer feeding cables. The primary

of the boosting transformer is bridged across the main bus-bars, and the secondary is in series with the main circuit.

The old single-phase distributing network has been maintained unaltered, except so far as concerns the changes to the arc lamps, meters and some transformers in view of the reduction of the frequency to 50 cycles, and a certain amount of rearrangement of circuits, so as to divide them equally between the two phases. Some new sub-stations have, of course, been added, and some of the old ones enlarged; and two-phase current is taken to the power consumers by means of cables independent for the most part of the old single-phase lighting circuits.

For the purpose of facilitating the change in wiring, a portable sub-station was made, consisting of transformers and switch gear contained in a covered horse-drawn trolley car, and this proved of considerable service, having in some cases been in use for months in one position during the building of the permanent sub-stations.

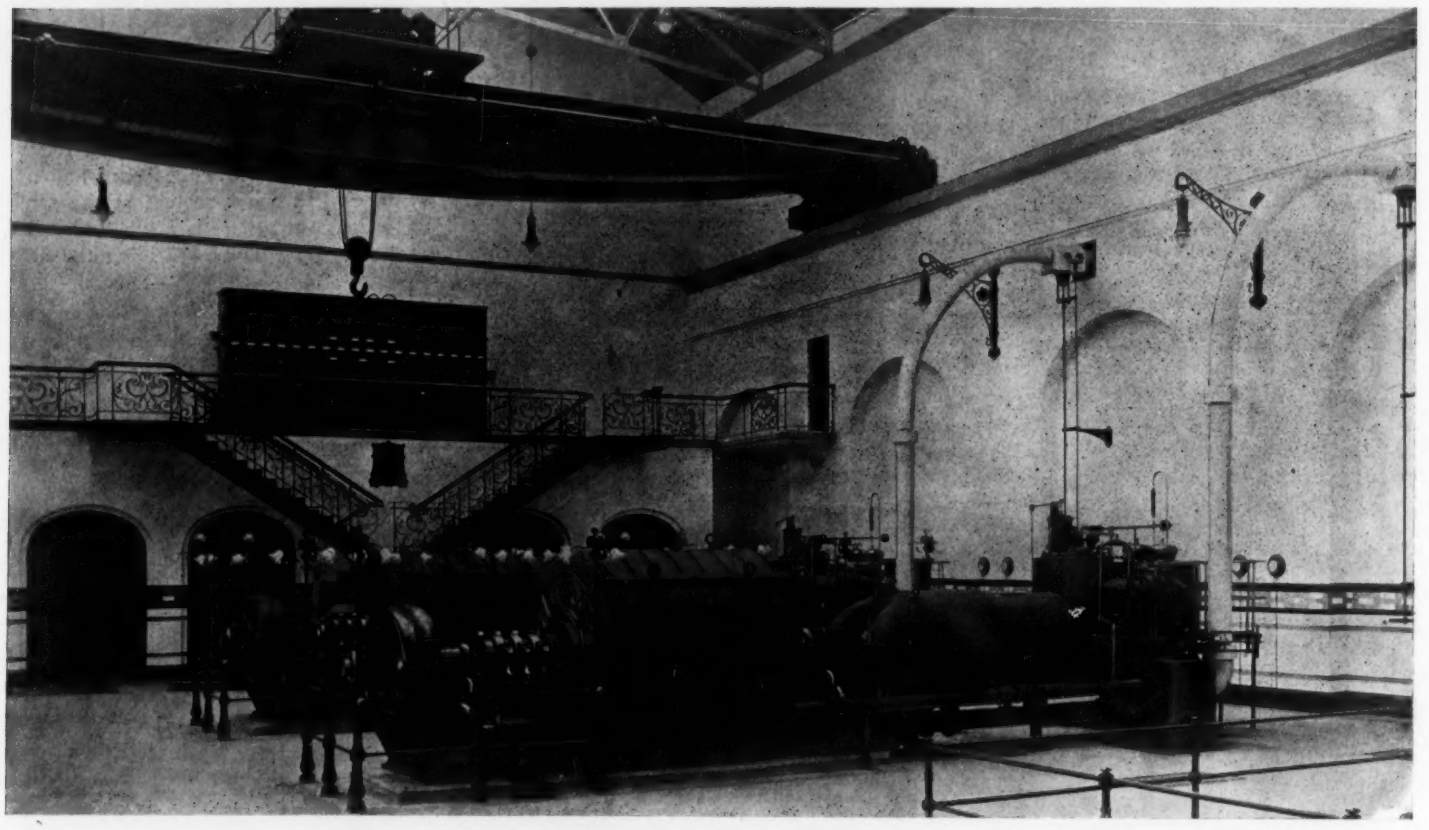


FIG. 2.—INTERIOR OF POWER STATION.

Voltage, Potential and Direction of Transmission.

BY J. STANLEY RICHMOND.

DURING the past few years I have been actively engaged on some problems which have been the cause of a considerable amount of controversy in connection with the relative meaning of the terms voltage, potential and direction of transmission. As a point of view which differs greatly from that usually taken may not be without interest, I give below my conception of these terms.

Any body of gas can have a pressure, which is measurable with a pressure gauge, and any other body of gas can have a different pressure similarly measurable. The difference of the pressure of such two bodies, if correctly applied to a suitable piece of apparatus, will be productive of work. That is, if one body of gas be applied on one side of the piston of an engine and the other body of gas on the other side of the same piston, work will result.

All bodies have their molecules in a certain condition, which can vary and to which the term voltage is applied. Two bodies or two points of one body differing in their voltage are productive by correct manipulation in work performed. Such difference of voltage between two bodies or two points of one body is termed potential. Direction of transmission requires no explanation.

Now, in the majority of problems which confront engineers in dealing with the transmission of energy electrically, the diagrams which are commonly used serve all practical purposes. But one has to be more particular in the use of illustrations to explain some of the problems arising from a certain phase of cross-induction—which has been termed electrostatic capacity.

Using curves to illustrate voltage, potential and direction of transmission and assuming that the generator in the examples illustrated is a single-phase alternator generating 1,000 volts potential, and that there exists an earth connection which can be disconnected from the generator or connected to either of its poles, *A* and *B*, or midway between them, then, when *B* is earthed, the curve, *A A′ A″ A‴*, in Fig. 1, represents the voltage of *A* during two complete cycles, while the straight line, *B B′ B″ B‴*, represents the voltage of *B* during the same two cycles. Thus, in this case and if the line *B B′ B″ B‴* be taken as zero, the curve represents not only the voltage of *A* but also the direction of transmission. But the curve does not represent the potential generated. For above a zero line

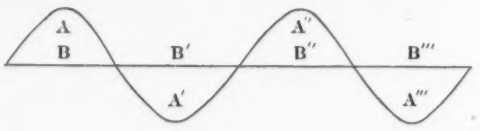


FIG. 1.

means "more than zero" and below it means "less than zero"; and as potential means "ability to do work," and as zero potential means "no ability to do work," then to say that the curve in Fig. 1 describes

FIG. 2.

the potential generated is equivalent to saying that during each half of each cycle there exists a varying amount of less-than-no-ability to do work—which is an absurdity. To correctly describe a poten-

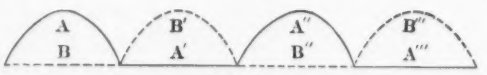


FIG. 3.

tial curve in this or any case requires that the curve shall always be above the zero line, as shown in Fig. 2.

If no earth connection existed at the generator, then, in Fig. 3, *A A′ A″ A‴* will represent the voltage of *A* during two complete cycles and *B B′ B″ B‴* will represent that of *B* during the same

period. In this case the direction of transmission will be from *A* to *B*, *B'* to *A'*, *A''* to *B''* and *B'''* to *A'''*, and such (direction of transmission only) can be described by a curve similar to that in Fig. 1, while the potential will have to be described by a curve similar to that of Fig. 2.

With the pole *A* earthed, diagrams similar to those used when *B* is earthed, but reversed, will have to be used.

If the medial point (midway between the poles) is earthed, then,

FIG. 4.

in Fig. 4, *A A' A'' A'''* will represent the voltage of *A* and *B B' B'' B'''* will represent that of *B*, while the direction of transmission and potential will have to be represented, respectively, as in Figs. 1 and 2.

Power Generation and Distribution at a Large Railroad Shop.

The Chicago, Rock Island & Pacific Railway Company has built at East Moline, Ill., a large locomotive shop, which shows careful consideration of details in its design. An arrangement most admirably adapted to economical working has been produced without resorting to the use of any complication of devices for performing difficult duties. In fact, the extreme simplicity of everything about this large plant is perhaps its most striking feature, aside from the noteworthy precautions taken to avoid any shutdown from failures at the power plant. One of the illustrations (Fig. 1) shows the general arrangement of the buildings, which are constructed of brick, with comparatively flat roofs, carrying monitor skylights. The main locomotive shop building is divided into five aisles, of which the center one, 100 ft. in width, is occupied by the erecting floor. The heavy, individually-driven machine tools are in the south intermediate aisle, and the lighter group-driven machine tools are in the south bay. The boiler and tank shops occupy the other side of the building, with the lighter tools similarly arranged in the north bay and the heavier ones in the north intermediate aisle. The three inner aisles are supplied with overhead traveling cranes.

The power house, an end view of the exterior of which is given in Fig. 2, is divided longitudinally by a brick wall into an engine room and a boiler room, each 50 x 150 ft. in size. A front elevation of the boiler room is shown in Fig. 3, from which it will be seen that eight boilers are provided, with space at each end of the row for an additional boiler if needed in the future. Only six boilers are at present in place. The boilers employed are Babcock & Wilcox, of 300 hp each, working at 150 pounds pressure. They are mounted two in a battery and are fitted with Green chain grates, using for fuel a very low-grade of bituminous coal. The boilers stand in a row, with 10 ft. between their back ends and the dividing wall of the building. This space is utilized for the brick breeching, and also allows room enough for a man to work on the back heads of the drums. At the center of the row the boilers are separated for a connecting passageway between them to the engine room, and over this passageway is carried on columns the economizer, which leads from the breeching out across the boiler room to the uptake at the outer wall. Alongside the Green economizer, in the same casing, is a by-pass for use when the former is being cleaned or repaired, and the gases are directed by Louvre dampers through whichever passage it is desired to use. Other dampers in the breeching close to the economizer allow either side of the boiler battery to be cut off. Some spouts, with tight-fitting covers, project downward out of

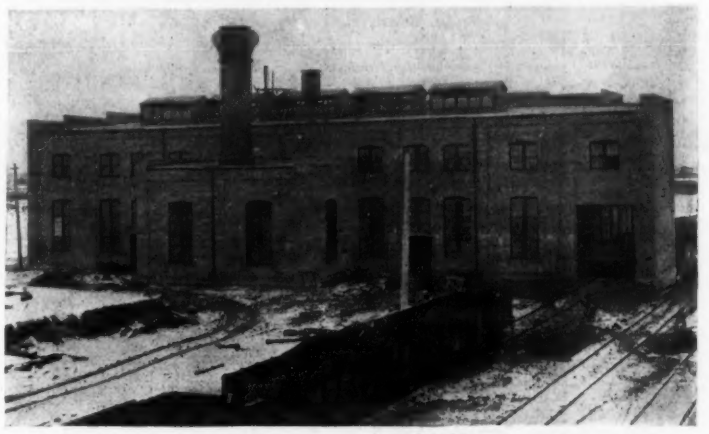


FIG. 2.—EXTERIOR OF POWER HOUSE.

the floor of the economizer chamber. Bags are tied over them to collect the dust and soot swept down in cleaning the tubes of the economizer, thus preventing any of the dirt from getting out into the room. The draft is induced by one of two Buffalo Forge Company's steam-driven fans, which are located in the uptake. Vertical dampers cut off whichever fan is not in use. Worthington Admiralty feed pumps are installed on the sides of the passageway below the economizer and deliver into the boiler feed main through the economizer. A by-pass is provided, however, in case the economizer is out of service.

A Hunt conveyor brings the coal from a dumping hopper and steam-driven crusher just outside the building up overhead in front of the boilers, each of which has a 32-ton storage bin. The conveyor descends at the farther wall, and collects the ashes from below the boilers on its outward run. It deposits them in a hopper over the supply track outside, whence they are dumped into a car set for the purpose. The crusher and conveyor are driven by steam in preference to electricity, because occasions arise when it is desired to handle coal and ashes at a time when no generators are running. Moreover, in case of the stalling of either conveyor or crusher, an engine will merely slow down and stop, while a motor would probably be burned out. The boiler room is finished in dark red pressed brick, and the engine room in yellow pressed brick, with a wains-

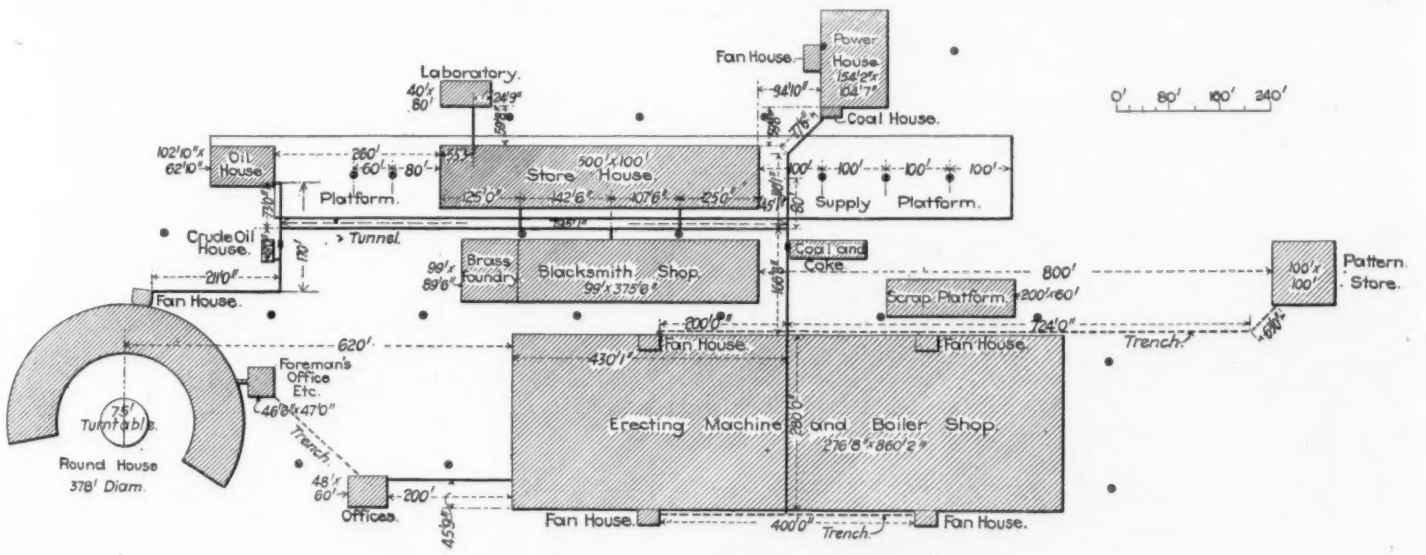


FIG. 1.—GENERAL LAYOUT OF THE BUILDINGS.

coting of white glazed tile, trimmed with a baseboard and coping of dark green. The machinery is also painted dark green, and this treatment gives the interior a very neat appearance.

As will be seen from the drawing (Fig. 4) two compound Worthington duplex pumps and an accumulator for the hydraulic machinery and two Ingersoll-Sergeant two-stage air compressors occupy

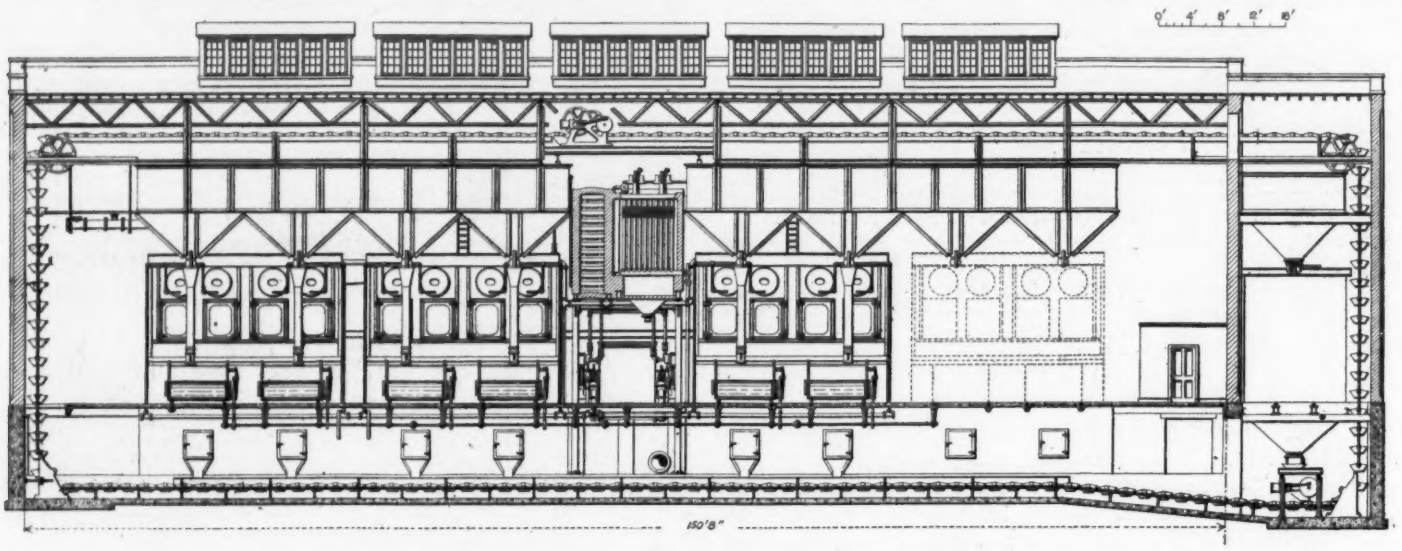


FIG. 3.—ELEVATION OF BOILER ROOM, SHOWING MECHANICAL STOKERS, ASH-HANDLING APPARATUS, ETC.

one end of the engine room. The electric generators are General Electric, 250-volt, direct-current, each direct-connected to a Buckeye cross-compound engine. One machine is a 500-kw unit, operated at 130 r.p.m., and the other a 250-kw at 150 r.p.m. Space is provided for an additional 500-kw unit, as shown by dotted lines on the plan view. The Holly drip and Siegrist automatic oiling systems are used, and a 10-ton overhead traveling crane operated by hand power serves the entire engine room floor.

The water supply is obtained from the Mississippi River at a point about two miles from the shop. The pumping station is located on the bank of the river and the current for its operation is obtained from the main power house. In the engine room a General Electric inverted rotary converter of 50-kw capacity delivers alternating current at 25 cycles to an oil-cooled transformer, which raises the e.m.f. to 2,300 volts, for transmission to the pump house (Fig. 5). At the pump house the current is fed directly at 2,180 volts to a General Electric 50-hp, three-phase, 25-cycle induction motor, direct-connected to a Deming triple-cylinder pump with a capacity of 750 gallons per minute. A duplicate pump at the other end of the pumping station is connected to a 60-hp Otto gasoline engine as a reserve for emergencies. The pumping station line has a separate two-panel switchboard, seen at the back of the engine room, which carries the direct and alternating-current instruments and the circuit-breaker for the line. A manually-operated oil switch and compensating starter are installed at the pump house for operating the pump motor.

Hot water from the Webster feed water heater is supplied on a system of continuous circulation to all the buildings by lines of piping carried through the tunnels. The outgoing lead is 2½-in. pipe, the return is 1 in. in diameter, and the pressure is about 40 pounds. A circulation is maintained in the loops, thereby giving good hot water at any point immediately upon opening the valve.

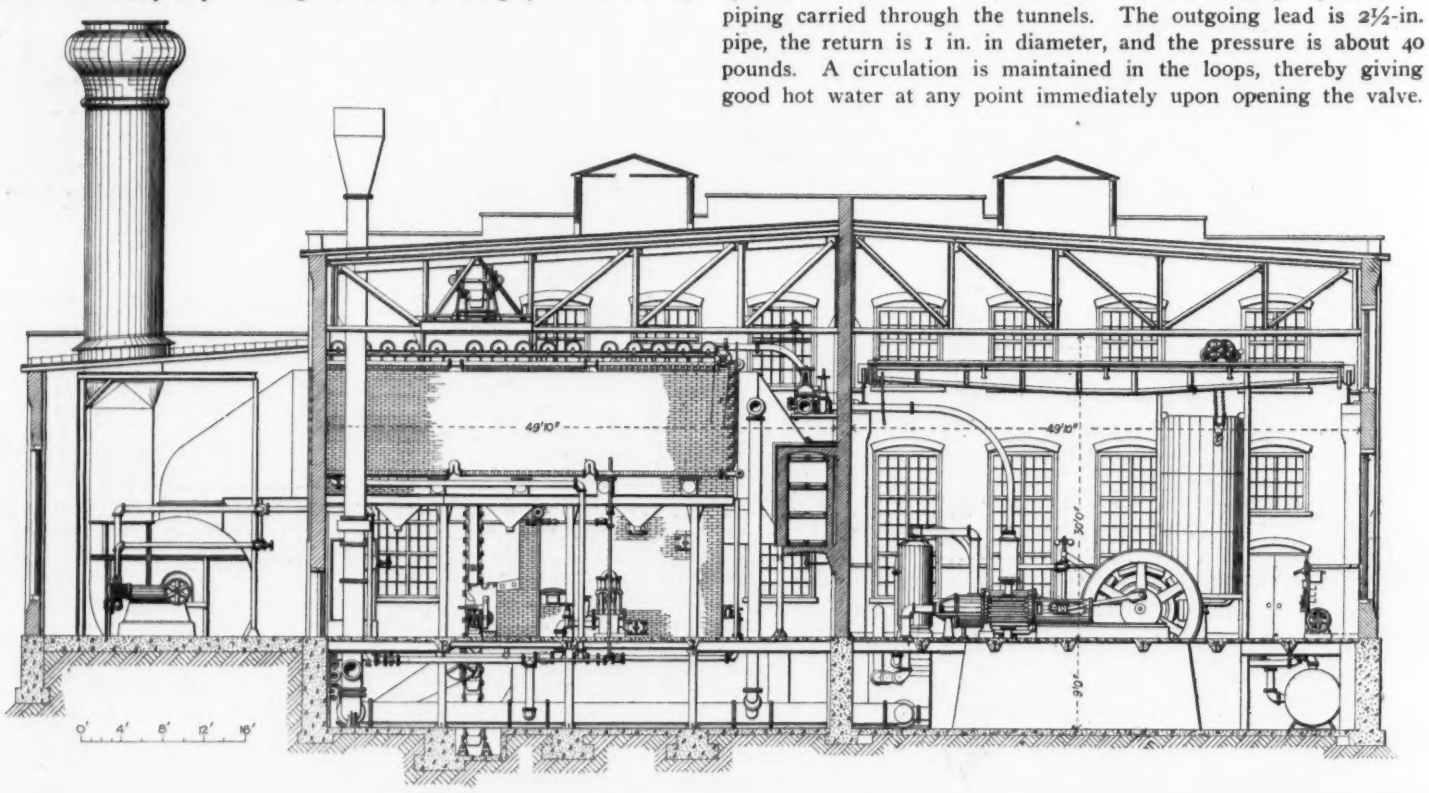


FIG. 4.—CROSS-SECTION VIEW OF POWER HOUSE.

This is done by a three-stage centrifugal pump, located in the engine room basement and driven by a compound-wound 10-hp General Electric motor, which operates continuously. The water pressure is determined by the quantity of the discharge, and this is varied by regulating the speed of the pump. A solenoid governor varies the resistance in the shunt field circuit of this motor, according to the water pressure, thereby maintaining better efficiency than by the customary method of armature resistance control. A variation of 10 per cent. in the speed of the pump will produce a variation of 3 to 1 in its output.

POWER DISTRIBUTION.

The electrical load is divided into five classes of service supplied by eight feeders, as follows: 1, cranes, 185 kw; 2, heating fans, 245 kw; 3, constant-speed machine motors, 415 kw; 4, variable-speed machine motors, 175 kw; 5, lighting (4 feeders), 189 kw; a total of 1,209 kw. Of these, the first three are two-wire, 230-volt lines, and

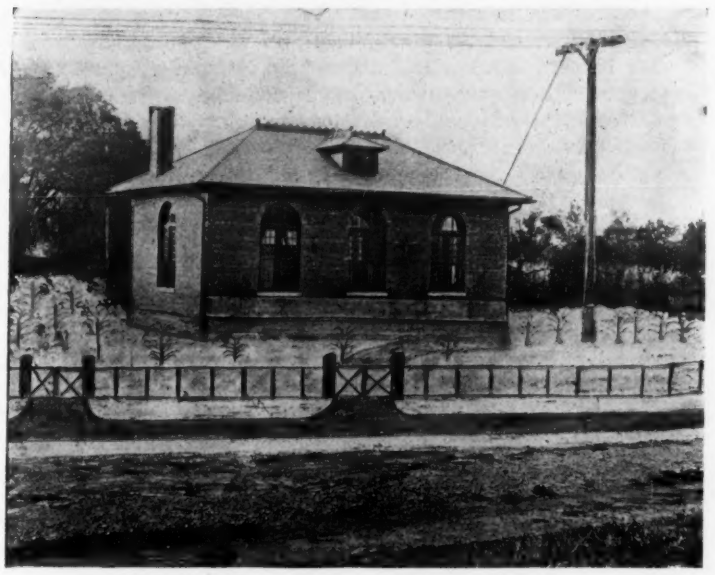


FIG. 5.—EXTERIOR OF PUMPING STATION.

the two last are three-wire, 230-115-volt lines, the intermediate voltage being obtained by two Bullock balancer sets placed on the engine room floor near the main switchboard. Figs. 7 and 8 show front and rear views of this switchboard, which was built by Kohler Bros., of Chicago. It has twelve panels assigned as follows: 2, generator; 1, totalizing; 1, cranes and heating fans; 1, constant-speed motors (also to carry wood-working machinery later); 2, balancer; 1, three-wire, variable-speed motors; 4, three-wire lighting. The load factors for maximum current demand on the various feeders were allowed as follows: Cranes, 800 amp. (arbitrarily determined); heating fans, 100 per cent. rated capacity; constant speed, 75 per cent. rated capacity; variable-speed, 65 per cent. rated capacity; lighting, 1,645 amp., 100 per cent. rated capacity. The size of the motors used for group driving was set at 50 per cent. of the total maximum capacity of all the tools in that group.

All wires and piping, including the live steam line to the seven hammers in the blacksmith shop, the steam heating and return lines, the compressed-air main, carrying 1,500 pounds pressure, the hydraulic main and the hot water supply loops are carried from the power house to the various buildings in an underground tunnel system, aggregating 2,100 ft. in length. One of the illustrations (Fig. 1) shows the general layout of the buildings, and the location of the tunnels, also cross-sections and details of the same. The tunnel is built of concrete, with its top 2 ft. below ground. The inside height is 6 ft. 6 in., and the width is 6 ft., 5 ft. or 4 ft., according to the demand for space within. At several points in the tunnel roof are located openings 2 ft. 8 in. wide, by 8 ft. long, for the purpose of introducing the lengths of pipe into it. These openings are covered by substantial grids. Provision is also made for ventilation and drainage. Wherever the tracks in the yards above cross the tunnel its roof is strengthened by old rails laid crosswise. The wires are led from the switchboard down through a slot in the concrete floor directly in rear of it, and then along the basement ceiling in cage brackets to the terminal cuts. The pipes are carried at one side of the tunnel and the wires at the other. Upright pieces of 6 x 4 oak are set into the concrete sides of the tunnel every 6 ft., and to these are lag-screwed the cast-iron brackets carrying the cast-iron chairs for the pipes, or the glass insulators for the wires, which have merely a weather-proof covering. It will be seen that the tunnel extends completely across underneath the machine shop from side to side. The wires to the variable-speed motors are tapped off at the most convenient point and led underneath the floor to three distributing boxes located on columns. The heating fan, crane and constant-speed motor wires are led in to the center of the building, and then branch both ways to the motors, those to the crane trolleys are tapped on at two points, one each side of the center. A reference to the general plan of the shops will materially aid in locating the various motors enumerated in the following tables.

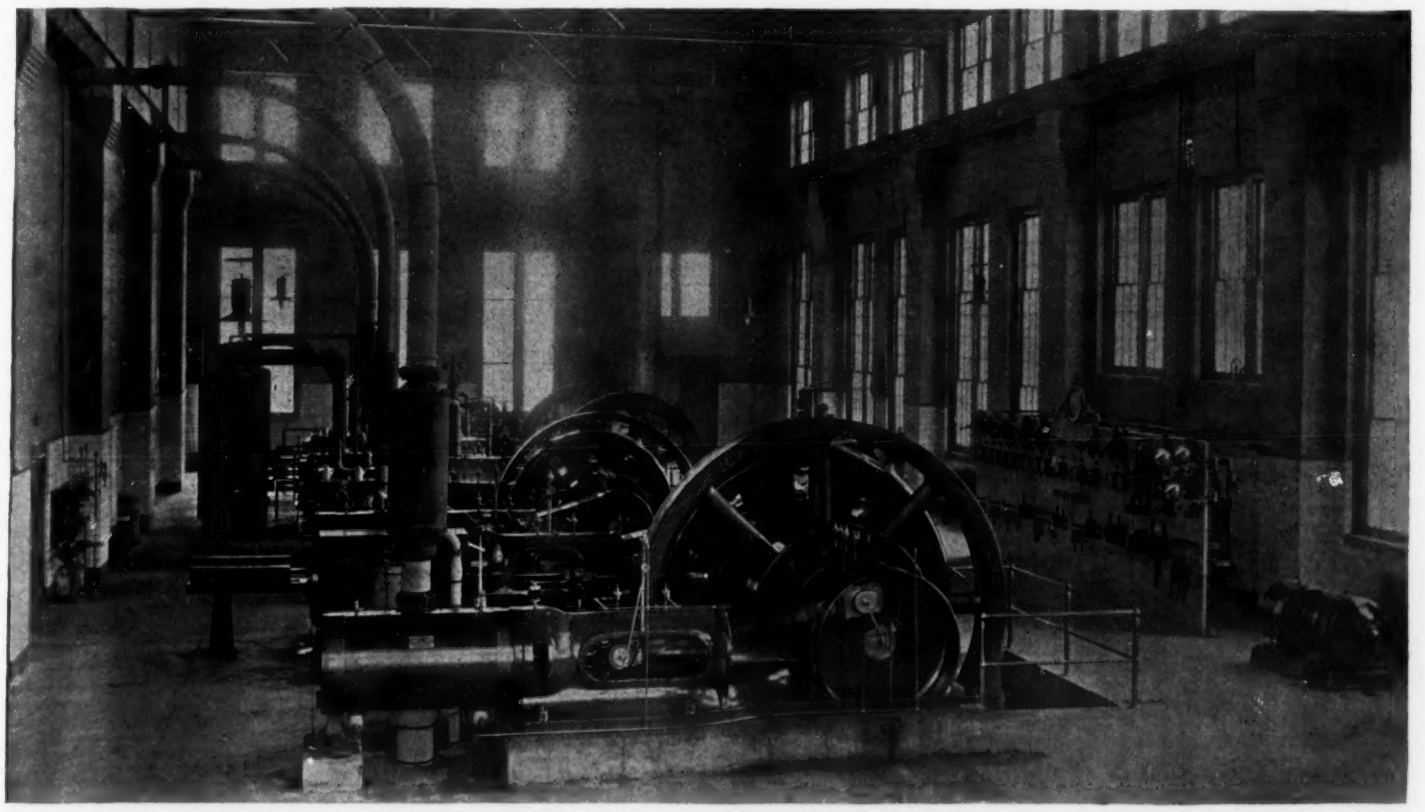


FIG. 6.—INTERIOR OF ENGINE ROOM.

The first feeder supplies the overhead traveling cranes, the capacity and location of which are given as follows: Erecting shop—Two 50-ton, central aisle; one 20-ton, north intermediate aisle; one 10-ton, south intermediate aisle; one 5-ton, north intermediate aisle; two 3½-ton, south intermediate aisle. Storehouse platform—One 5-ton, serving 400 ft. of platform space and 1 track. The second feeder

supplies the heating fans, which are located as follows: Four 50-hp, erecting shop; two 25-hp, storehouse; one 35-hp, blacksmith shop; one 35-hp, engine house. The third feeder supplies the constant-speed motors, which are located as follows: Machine shop—South bay, 11 groups connected to shafting by Morse chair drive; six 25-hp groups; four 15-hp groups; one 10-hp group. North bay, boiler shop—One 40-hp, 14-ft. bending holls; one 10-hp, 86-in. bending rolls; three 15-hp groups; one 10-hp group; one 15-hp oil furnace

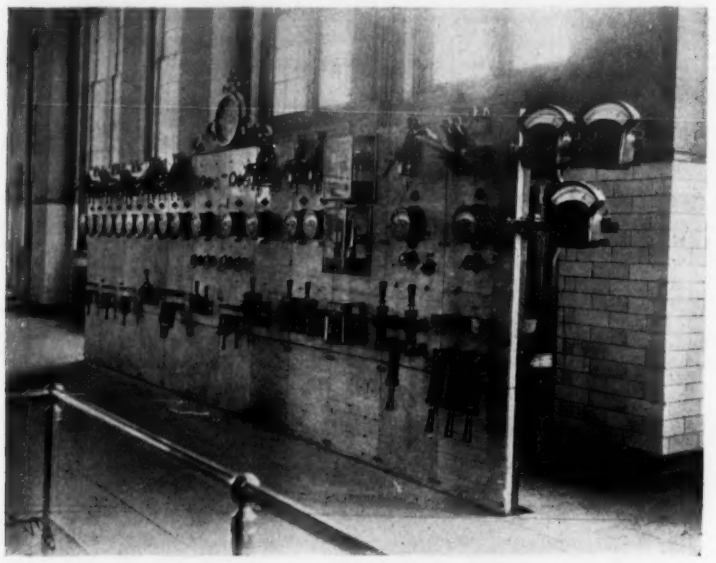


FIG. 7.—VIEW OF FRONT OF MAIN SWITCHBOARD.

blower; one 17½-hp Westmark flue rattler. Blacksmith shop—One 25-hp group; one 15-hp group; two 25-hp blowers; one 15-hp blower. Storehouse—Two 22-hp direct-connected elevators; coal chute, one 50-hp, direct-connected to a Lidgerwood hoist. This last is designed to pull 150,000 pounds (car and lading) up a 15 per cent. incline 225 ft. long at a speed of 40 ft. per minute. The motors on the above three feeders are all Crocker-Wheeler, 230-volt machines.

The fourth feeder supplies 29 General Electric type C. K. variable-

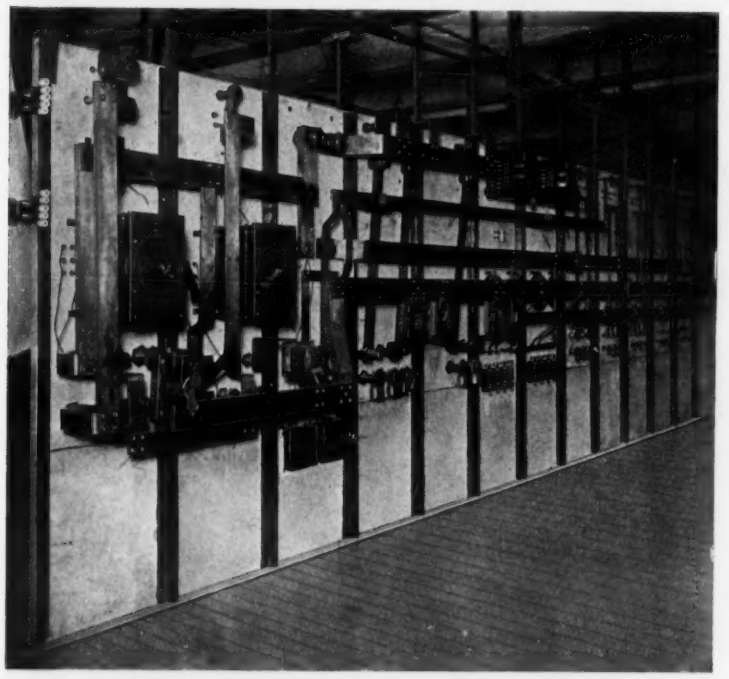


FIG. 8.—REAR OF SWITCHBOARD.

speed motors ranging in size from 20 to 2½ hp, with a total rating of 233¼ hp. These are all mounted to drive individual machines in the south intermediate aisle of the machine shop. They are controlled by varying the field resistance, a speed range of 100 per cent. being obtained on each voltage, thus giving a total speed ratio of 4 to 1. The controllers, of General Electric make, contain the field points for speed regulation as well as the armature points for starting the motors. Those for the double-voltage also contain the voltage changer, all operated from a single handle.

The remaining four feeders are the three-wire lighting circuits. The machine shop has in all 84 enclosed arc, 6½-amp., 115-volt lamps placed 16 ft. above the floor, in alternate panels in the side bays, and on the side of alternate columns over the erecting floor. There are also eight along the roof over the cranes. Each of the larger tools has sockets for two incandescent lamps, the smaller tools having but one apiece, and there are plugs and 100-lamp stands provided on the benches between the pits and in the south bay. The total number of incandescent lamps in this building is 502, exclusive of those connected with the bench plugs.

The blacksmith shop has 28 arc lights, carried on the wall pilasters and under the roof, and 22 arc lamps are hung on poles in the yard, while four arcs have been placed over the turn table at the engine house and 300 incandescents within the building.

The storehouse which is a three-story building measuring 500 ft. x 100 ft. has an allotment of 500 incandescent lamps. In the power house there are eight arc lamps in the engine room, four in the boiler room and 40 incandescent lamps distributed between both rooms. The tunnel has 60 incandescent lamps. On the erecting floor are three portable, 5-hp, variable-speed motors. Each of these motors, together with its controller, is mounted on a four-wheeled truck, which is easily handled by one man and is blocked in any desired position for using the motor in driving. The three-wire sockets on the erecting benches referred to above are designed for 40 amp., and the connection to these portable motors is made by a three-wire plug, while the lamp plugs have only two contact points, but fit into the same sockets. These motors carry small pulleys for driving belts, and have proved equal in flexibility of operation to pneumatically driven machines.

The usual committee with full power to construct and equip the new shop was appointed by the railroad company. On this committee were Mr. M. K. Barnum, superintendent of motive power; Mr. C. A. Seley, mechanical engineer, and Mr. F. S. Forbes, purchasing agent. The buildings were erected by George B. Swift & Co., of Chicago, the contractors. Mr. C. H. Wilmerding, of Chicago, was the consulting engineer in the design and supervision of the mechanical and electrical features.

Telephony on the New York Central.

The New York Central & Hudson River Railroad is now equipping a special telephone line between New York and Chicago terminals. Construction is now in process. We learn from Mr. A. B. Taylor, superintendent of telegraph, that the company is erecting over its West Shore division, between Buffalo and New York, and the Lake Shore division, between Buffalo and Chicago, two No. 8 B. W. G. copper wires, 435 pounds to the mile, expecting to use the trunks for service between New York and Chicago and the principal intermediate points. Mr. Taylor says:

"This line will be connected to our own private branch exchanges at Albany, Syracuse and Buffalo. The construction of the line has nothing whatever to do with the dispatching of trains, but with the idea of furnishing communication between the principal points, New York to Chicago, and relieving our telegraph wires to that extent. It is probable, also, that we shall composite the circuit for telegraph purposes, between New York and Chicago and several of the intervening cities, but our first purpose is to make a good telephone line.

"It is probable that the construction of these trunks will be followed by the building of subsidiary lines over various divisions affording communication locally, and which, through private branch exchanges, can be cut into the long-distance trunks, when necessary. In putting up this line we followed the West Shore route for two reasons: First, because it is the shortest New York Central line between New York and Buffalo, and second, because the line conditions, owing to the fact that the West Shore runs through a great deal of new open country, are much better than they would be on any other route. We recognize, of course, the fact that telephoning between New York and Chicago is about the limit of the art in distance, at the present time, and we will no doubt find many details to be adjusted to give satisfactory service, but see no reason why we should not accomplish the result aimed at."

The Evolution of Telephonic Protective Apparatus.

BY CHARLES H. COAR.

FROM the time the public first conceived the usefulness of the telephone to the present, a large number of patents have been granted on appliances and apparatus which were designed to afford to telephone systems protection against all abnormal electrical conditions and currents other than those intended for their operation. In consideration of the fact that patents selected for manufacture are in general as near perfection as is obtainable in their different operations, there must exist some condition radically wrong if one judges from the large amount of capital annually lost through the destruction and disabling of exchanges by lightning or similar causes. To the omission of protective apparatus or parts pertaining thereto in telephone lines can be traced in many instances the indirect means of the destruction of exchanges, while the negligent care of apparatus installed has enlarged the amount thus lost, and it might be safely stated that one of the principal reasons why protective parts are omitted or negligently taken care of is that some of the persons installing the equipment or having it in charge possess blissful ignorance concerning the different results fuses, carbons, heat coils and earth connections are expected to accomplish.

The three metal plates, as shown in Fig. 1, which are still placed

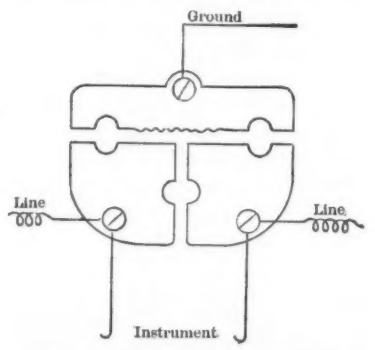


FIG. 1.—LIGHTNING ARRESTER.

on some of the modern magneto telephones, was undoubtedly the first appliance generally adopted for the protection of the telephone and, from the early days of the series telephone to the time of the successful operation of central energy systems, this same arrangement was very much in evidence, and, while it can hardly be said that they offered the telephone any protection against excessive currents, they have many times prevented destruction by lightning.

Arresters of this description usually have three sections of metal so arranged that the ground section or plate presents sharp points in close proximity to the two remaining sections, or line plates, and holes are provided in the different plates for the admittance of a brass plug between any two plates, in order that the telephone may be cut into or out of the circuit by the insertion of the brass plug in the proper hole, so that in reality this arrester may serve two purposes, namely, that of protecting the instrument against lightning and of acting as a cut-out or switch. It is well known that lightning tends to seek a path to earth and the idea embodied in the construction of these arresters was to provide an easy path to earth for all lightning or static accumulations on the line, and for this reason the different plates were placed as near each other as was permissible in telephone service.

As all currents of high potential, such as those associated in the lightning, seem to dissipate themselves to and from sharp points much more readily than from smooth surfaces, the ground plates in these arresters were so placed that a portion of the teeth was allotted to each of the remaining plates, and in this arrangement the lightning was expected to leap from the line plates across the small intervening space to the points on the ground plate and thus to earth itself.

During the early days of telephony there were no electric railways upon the streets and no dangerous trolley wires and feeders and electricity was not extensively used for lighting or power purposes, so it was not necessary to provide the telephones with protection against destructive currents other than lightning, and the slate arresters furnished suitable protection. However, as electricity became more and more in use and wires carrying dangerous current more in evidence, there had to be adopted some other means which would protect telephonic apparatus against destructive currents against which it was becoming necessary to contend.

To protect the telephonic apparatus against these currents, some conducting substance which would rupture the circuit upon the passage of abnormal currents was deemed necessary, and for this reason fuses were inserted in the telephone circuit in combination with the plate arrester, as shown in Fig. 2, and in this manner suitable pro-

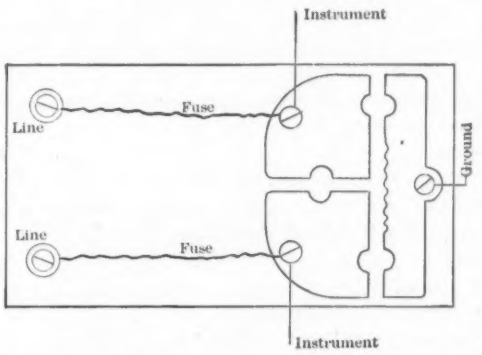


FIG. 2.—COMBINATION OF FUSES WITH PLATE ARRESTER.

tection was supposed to be obtained. Numerous patents were granted in which the predominating idea was to produce a convenient mounting arrangement of the lightning arresters and fuses, so that they could readily be handled and repaired, and it was largely due to these endeavors that the familiar carbon brick arrangement, as shown in Fig. 3, superseded the plate arrangement. One grave fault found with the plate arresters was that upon the event of a storm subscribers would often plug their telephones out of service, thus making sure of protection, but some of these subscribers would forget to remove the plug from its position and consequently their telephone or ofttimes the whole circuit depending on the system would be placed out of service until a repairman came and removed the plug, frequently at considerable expense to the company. One other fault found with this arrangement when the plates were placed on top of the bell box, was that subscribers were continually placing upon these plates bric-à-brac of all description, resulting in trouble of a kind most difficult to locate. Carbon bricks, which have gradually become universally used in connection with protective apparatus, are capable of arresting this trouble and they have proved efficient in operation.

Two small bricks as shown in Fig. 4 are insulated from each other by a piece of mica or silk cloth slightly larger than the bricks, and

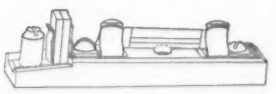


FIG. 3.—FUSE.

FIG. 4.—LIGHTNING ARRESTER.

are so placed that one brick is in connection with the line while the remaining brick is connected to earth. In this arrangement the lightning is expected to jump through the space provided in the silk or mica, from the line carbon to the earth carbon. One detrimental feature in connection with carbon arresters is that during the time that lightning discharges occur over them, small particles of carbon are disintegrated, making the line noisy or partially short-circuiting it, so it is often necessary to clean between these bricks after a storm.

But with this supposed perfection there was some protection lacking, for at times crosses would occur with electric circuits, through which small currents not strong enough to rupture the fuses escaped to the telephone apparatus, causing so much heat to be generated by their constant flowing that ofttimes the apparatus or exchange was ultimately destroyed. Currents of this description were appropriately termed "sneak currents," and their elimination was one of the most difficult problems with which telephone engineers had to contend.

Mr. Hammond Hayes, in all probability, deserves great credit for having devised the first appliance intended to protect telephone apparatus from "sneak currents," because his thermal coil was the forerunner of all the successful heat coils of to-day. Mr. Hayes' scheme was to place a bobbin of fine wire in series with the line wire, so that upon the passage of a steady current larger than a certain value, enough heat was generated in the coil to release a

small pin in its center, allowing it to be forced to an earth connection by means of the contact springs in which the bobbin was placed. The shell of the bobbin was used as part of the circuit and the pin was held in normal position by a small amount of fusible solder. Upon the passage of a "sneak current" through the coil, the heat generated was expected to melt the solder, which in turn would release the pin, thus grounding the line, and if the current thus flowing was large enough it would rupture the fuse located between the electric cross and the heat coil ground, because comparatively no resistance remained in the circuit to oppose the foreign current. To further insure a good earth connection for such currents, one of each pair of carbon bricks has inserted in it a drop of fusible alloy, which melts and flows across the space provided in the silk or mica separation, short-circuiting to the other brick, whenever enough current passes to arc and heat the bricks sufficiently. Now it seemed that a suitable combination had been devised, but it was in the hands of the Bell companies and the next perfection, which is yet in vogue, went to the Bell, and the claims on both these patents were so broad and sweeping that it required great ingenuity as well as the expenditure of a large sum of money to obtain a patent on any similar apparatus.

Mr. McBerty patented and assigned to the Western Electric Company during this time an improvement on Mr. Hayes' patent, consisting of the arrester and its mounting, as shown in Fig. 5, which,

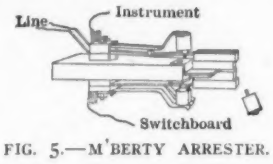


FIG. 5.—M'BERTY ARRESTER.

with the exception of a few minor details, is in use at the present time. This was the first compact and convenient arrangement suitable for a terminal rack for which it was intended.

After endeavoring a score of years, Mr. Frank B. Cook was granted during the year 1902 several patents on protective apparatus, which were possibly the first protective appliances having the heat coil arrangement, offered to the independents, and so far as I am aware Mr. Cook's heat coil differed considerably in its construction and mode of operation, as it tended to open the circuit upon operation instead of closing or short-circuiting as the heat coils heretofore patented did.

An arrangement of Mr. Cook's terminal coil, as at present used, is shown in Fig. 6. Just as soon as Mr. Cook's patents were granted

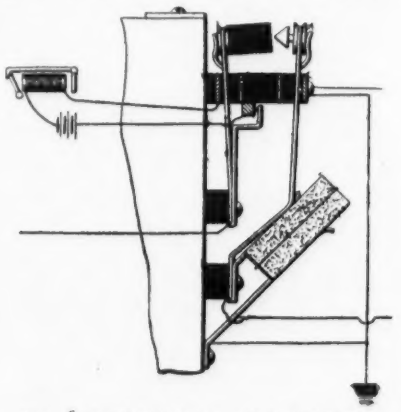


FIG. 6.—DIAGRAM OF COOK PROTECTOR.

there seemed to be scores of ideas revived, and many other devices of this description were offered the public, notable among which was a patent granted to Mr. Rolfe, known at the present time as the "Rolfe arrester."

Mr. Rolfe's thermal arrangement differed from the other heat coils inasmuch as all the parts entered into the construction of his coil performed some function during their operation, and embodied the idea of placing the resistance wire of the coil around a small rod of hard rubber, which was held in a state of tension by suitable terminal springs. During the passage of sneak currents there would be generated in the resistance wire sufficient heat to cause the rubber bar or rod to become pliable, after which the tension of the springs would force it out of contact, and thus insure the safety of the apparatus, and in connection with this operation suitable contacts were provided so that an alarm could be sounded whenever one of these coils operated, thus calling the attention of the attendant when necessary. Mr. Rolfe's protector is shown in Fig. 7.

As stated above, one of the detrimental features possessed by the carbon bricks was the disintegration of small particles of carbon dust during the passage of discharges from one brick to the other, which necessitated the cleaning of the parts if efficient service was to be had. A patent was granted and assigned to the Phonic Electric Company, on an appliance which tended to overcome this difficulty.

The idea, as shown in Fig. 8, was to have a vertical rod of carbon in close proximity to a predetermined number of carbon-tipped line terminals, so that as soon as a discharge occurred from a line tip

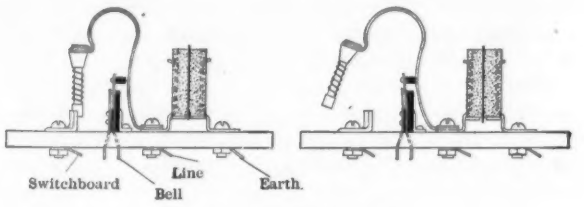


FIG. 7.—ROLFE PROTECTOR.

to the ground rod, the rod could be revolved in order that a clean surface could be presented to the line tip.

The advantage of closed fuses over those of the open type became evident during this time, due to the fact that during the arcing of fuses exposed materials were frequently ignited. The enclosed fuse proved its greater efficiency in rupturing at the proper current when kept at a more even temperature throughout its entire length. The fuse wire is usually enclosed in tubes constructed of non-inflammable material, such as fibre, and these tubes are provided with suitable terminals for their insertion into the different apparatuses. Some of the modern forms are shown in Fig. 9.

The method of installing fuses at the subscriber's station in the

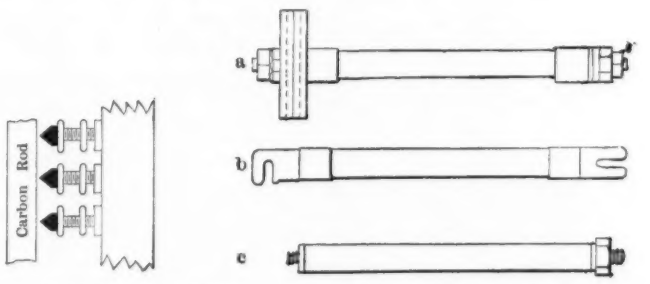


FIG. 8.—CARBON ROD PROTECTOR. FIG. 9.—FORMS OF FUSES.

earlier days is just opposite from that which is conceded good practice at present, inasmuch as the fuses in former times were inserted between the lightning arrester proper and the telephone, in view of having the lightning arrester in the circuit if the fuses were destroyed. At the present time, however, such methods would prove ineffective in many exchanges, for in case a cross occurred between a telephone line so equipped and any of the power circuits of our cities, the current from the live wires would be provided with a path to ground even when the fuses were ruptured, and the consequence of heavy current flowing into a subscriber's residence can be imagined. According to present practice the fuses are inserted

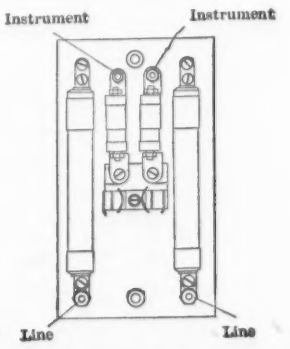


FIG. 10.—MODERN PROTECTOR.

between the lightning arrester proper and the line, and in case the fuses rupture the line is opened at this point.

Of late the tendency to install arresters at the subscriber's station

is diminishing, except in the case of long aerial lines, because they necessitate the maintenance of this additional apparatus outside the exchange, and during this period, when so many of the lines are in cables, it is considered best to insert fuses and arresters at the cable terminals, for in this manner most all the dangerous elements are attracted from the telephone instruments to places more easily repaired. A modern telephone protector, which consists of a combination of fuses, carbon bricks and heat coils, is shown in Fig. 10.

While different companies have different fuse specifications, the qualifications outlined below may be useful in indicating the requirements demanded by some of the larger companies.

1. It must operate with a current of —— amperes within —— minutes' time.
2. It must operate instantaneously with a current of —— amperes.
3. It must not be destroyed by ordinary lightning discharges.
4. It must possess no self-induction.
5. It must work equally well on grounded or metallic circuits.
6. It must not be operated by telephonic currents.
7. It must be so arranged that it will prevent the formation and continuance of an arc.
8. It must have no loose or double contacts whatever.
9. It must be so arranged that it can be connected quickly and firmly to the line.
10. It must not be totally destroyed when operated.

A telephone system considered as having efficient protection today must have apparatus which provides an easy path to earth for all static accumulations or lightning, and must be provided with a fuse capable of rupturing the circuit upon the passage of excessive currents; it must also have apparatus so sensitive that it will operate with small currents, termed sneak currents, which do not create any instantaneous damage upon their passage, but which ultimately destroys telephonic apparatus, and the combined effect of this apparatus when applied to line should not decrease its telephonic efficiency to any great extent.

To-day one may learn from the patent reports that a decided falling off in the appearance of arrester patents is occurring, and from this it would seem that there was no demand for new patents, or else that the ground has previously been covered so well that such patents are difficult to obtain. However, burn-outs still occur, sometimes owing to the eccentricities of lightning and frequently due to poor installations or mismanagement of equipment, but in view of all the good that has been accomplished we should extend to such men as Hayes, McBerty, Cook, Rolfe and others our appreciation for the beneficial results of their inventions in this important part of a telephone exchange.

Telephonic Tendencies.

The history of every branch of applied electricity brings to light many changes in the design of apparatus and the methods of adapting it to the varying requirements of commercial conditions. Practice considered standard when first approved by engineers has sometimes undergone no serious modification for several years, only to come finally face to face with the most revolutionary changes. The design of alternators supplies an illustration, through the reduction in magnet poles and alteration of both the exciting and magnetic circuits necessary in direct-connected steam turbine units on account of the high rotative speed of the new prime-movers. Still another case in point is that of power distribution on electric railways—practice destined to be greatly modified by the introduction of alternating motors. Perhaps the field of telephony affords an example of regular development scarcely equalled by any other line of electrical work. The idea has gained ground in some quarters that telephone practice has become pretty well standardized in the last few years, and that no very great advances have been made lately, but these conceptions are much in error.

Telephone development has been a matter of steady growth during the last five or ten years and consequently has not attracted the attention which has been focused upon other fields of activity, such as wireless telegraphy, long-distance power transmission and heavy electric railway work. It is twelve years this coming fall since the famous New York-Chicago toll line was opened for business, and yet to-day the Bostonian cannot talk much farther west than Omaha. This fact by no means implies that technical difficulties stand between communication from the Rocky Mountains to the Atlantic coast—it is rather a matter of prospective traffic which will determine when a toll line twenty or twenty-five hundred miles long can be profitably built and maintained. The greatest advances have been made in central office equipment, although line and underground construction have also been vastly improved mechanically. Thus, in the latter branch of telephone work, a cable about 16 sq. in. in cross-section carries 300 twisted pairs of wires, while the earlier types required several hundred square inches of space for such a number of conductors. The quality of long-distance transmission has also been much improved in recent years.

The central energy relay lamp signal multiple switchboard is now specified in most new exchanges serving over 500 subscribers, in Bell circles. Efforts are being made, however, to increase the capacity of these boards beyond the 9,600 lines which have hitherto marked the multiple limit in the largest installations. The new jacks and plugs are so much smaller than the later standards that it is doubtful if progress in this direction can extend much further than 15,000 lines, if indeed this limit can be reached. There is little room to spare in the wiring of even a 9,600-line board. Along with the establishment of common battery central offices has gone a decided simplification of subscribers' station apparatus and a noteworthy reduction in maintenance charges. Iron wire is growing in disfavor for city work, particularly on account of the difficulties of satisfactory common battery transmission above four or five miles.

Automatic exchanges have now been installed in more than a score of cities and towns in different parts of the United States by independent telephone interests. Their operation is being watched with extreme interest by the entire telephone world and if the success which their advocates claim is realized, there is no reason to doubt that sweeping changes in central office equipment will follow in both Bell and independent ranks. Perhaps the most serious difficulty which the automatic exchange encounters is the burden of work that it throws upon the subscriber—a departure from the general trend of previous practice, which aims to give the subscriber as little work as possible. It would be rash to predict that this obstacle will not be overcome, and it is certain that the next five years will witness some interesting developments along this line.

The application of telephone service to railway telegraph lines is steadily making headway at the present time, although the delicacy of the apparatus and skill required in its adjustment preclude the rapid progress desired by the transportation companies. As far as it goes, the "railway composite system," as it is called, allows telephone conversations to take place over grounded telegraph lines without the addition of wire or interference in any way with the regular telegraph business. It has been devised especially to meet the demands of railroads for a service applicable to terminal or way stations. At last accounts 100 miles was about the limit of satisfactory working on iron lines, although this distance will probably soon be exceeded.

Power problems of importance are now confronting telephone companies as a result of the centralization of battery equipment at the operating offices. Storage battery plants, motor-generator sets and other apparatus now occupy considerable attention and there are many interesting questions of economy and maintenance to be settled by telephone engineers. There is room for good work in the study of depreciation in every form of equipment, from switchboard lamps to conduits.

Perhaps the most scientific work in telephony is now being accomplished in the traffic department, with the help of the engineers. Exhaustive studies are being made throughout the country of every detail of operation with the object of economizing time and expense in the handling of the voluminous business which modern city exchanges transact. The value of toll equipment is appreciated as never before, and no effort is spared to cut down the time of completing connections with distant offices. Sometimes some of the toll lines are brought directly into the local switchboard, and connections secured between cities thirty miles apart in fifteen seconds. This is called "rapid-fire" service in telephone parlance. There is also a tendency in Bell practice to improve methods of trunking from office to office in a given exchange—a development which may lead to the elimination of the present trunking switchboards in large city offices in favor of semi-automatic apparatus.

Within the last ten years the growth of the telephone business has been very rapid. The reports of the Bell companies show a six-fold increase in the number of outstanding instruments since 1893. There are now over one and a half million subscribers in these companies, and in the last four years the long-distance traffic has increased 82 per cent. There is no question that there is room for still greater expansion, particularly in the West and South, and the possibilities of growth appear to be limited only by the population of the country.

Synthetic Wireless Telegraphy.

By A. Frederick Collins.

RECENTLY the writer had occasion to review the entire series of United States patents granted in the class of wireless telegraphy, and the accumulated data indicated plainly that a prodigious amount of time, labor and money had been expended in the direction of improving the devices used either for the purpose of effecting longer distances, providing greater accuracy or for obtaining selectivity. It is obvious that the great majority of these patents are for imaginary improvements, and that many of these are merely "paper" inventions designed to forestall some unforeseen advantage which, in the adoption of new means for the attainment of wireless, may at any moment become an essential factor.

In view of the actual results attained based on patented inventions used in individual bone fide systems, it would appear that a wireless trust could be formed favorable not only to the success of the builders of instruments, but also to those who have to use them; in this case the price of securities might not only be maintained, but even advanced, since the purposes of such an alliance would be to provide one first-class, up-to-date apparatus embodying every feature of value known to wireless telegraph engineers. Those who have made even a casual examination into the merits of the different systems of electric wave transmission must have observed how each seems to hinge more or less upon some specific feature which in itself may represent the acme of progressive excellence, while the constituent elements forming the balance of the equipment are either of such antiquated or inferior design as to materially weaken the service of the entire combination.

This may seem like strenuous criticism of not only the different types of apparatus, but of the judgment of those who are responsible for them as well; but it must be taken into consideration that the art is yet very young and by the time the original patents have expired and electrical manufacturers can select the best that the wireless workers of to-day have so nobly striven to produce, then shall we have a wireless system approximating the efficiency and certainty, to say nothing of range and selectivity, that the present telephone system represents.

Many who have already passed through a lifetime of electrical development may object to waiting another quarter of a wave length of years to behold the finished product, as will others who are even clamoring for a commercial system better than that now available. For the benefit of both, the writer has had the temerity to select such portions of the various individualized types as appealed to him as the most perfect of their kind, and then to combine them into one general system, i. e., a synthetic arrangement which should give (*a*) a maximum distance with a minimum energy, (*b*) accuracy, (*c*) speed, (*d*) certainty of operation, (*e*) simplicity of adjustment, and (*f*) a commercial apparatus satisfying the demands of those who use them.

The different parts of a wireless telegraph transmitter comprise a source of e.m.f. for supplying the initial energy, a key for breaking

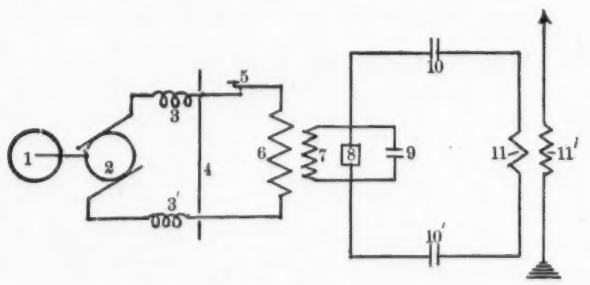


FIG. I.—SYNTHETIC TRANSMITTER.

up the current into dots and dashes, a transforming device for stepping up a low-voltage into high-potential currents, a spark-gap for converting the low-frequency currents into high-frequency oscillations, and a radiating system which includes the aerial wires, the disruptive discharge and the wire leading to the earth.

The source of energy may be either a direct or alternating current. In the earlier type of transmitters a direct current was always employed, and this was usually supplied by either primary cells or storage batteries; where available a constant current from a dynamo was occasionally utilized and was in all respects vastly preferable. In the last few years the situation has entirely changed and alternating-current machines have largely superceded all other generators.

The key interposed between the inductor of the transformer and the source of current has passed through a transition period as marked as any other one essential part of the apparatus. It was speedily ascertained when working with 9 or 10-in. induction coils that the platinum contacts of an ordinary Morse key would fuse under the heating effects of the current and so render the key useless; again, when dealing with increased current and higher voltages the danger factor was so large that it was a menace not only to the apparatus, but to the life of the operator, and this together with the high time constant of the receptive devices, made a modification of the regulation telegraph key imperative. A knife switch has been suggested, but is not a satisfactory substitute for a key, since the sound attendant upon the back stroke of the lever is essential to the operator in forming the code. To obviate all these difficulties a key having two or three times the dimensions of the Morse was designed and worked well, except for the excessive sparking at the contacts. To reduce this a number of devices have been made use of, such as a condenser shunted across the contacts, an air-blast or a magnetic blow-out placed at the juncture of the contacts.

Dr. Lee De Forest hit upon a plan for utilizing a Morse key of usual dimensions and capable of breaking heavy currents. In De Forest's key the lever has a curved projecting arm extending into a compartment containing oil; the end of the arm carries a contact of comparatively small surface, and oppositely disposed to it is a stationary contact. From these contacts well-insulated leads connect with the transformer and generator. It will be observed that only the manual portions of the key are exposed, and these are thoroughly insulated since the break where the spark takes place is submerged in oil. A current representing energy of one or two kilowatts may be readily broken up, and for speed and simplicity it cannot be excelled. This, then, will be the key adopted for our synthetic wireless telegraph transmitter.

A few years ago the induction coil, provided with an automatic interrupter, was universally used for converting low-pressure direct currents into alternating currents of high potential; in consequence the induction coil with its attendant make-and-break device passed through a long and tedious process of evolution, bringing it to what is probably its highest degree of efficiency. The interrupter has proven a variable factor to such an extent that it has made the design of induction coils empirical and unscientific. Again, only a limited current can be successfully broken at a rate high enough to be economical.

In order to eliminate the unknown factor of the interrupter and to obtain a disruptive discharge of requisite current strength for long-distance transmission, Marconi has adopted Fleming's method, and De Forest has obtained excellent results with small units of this type. Fleming's method employs an alternating-current generator instead of a direct-current machine as the initial source of energy. The generator may be driven by a gas, gasoline or electric motor, and Fessenden has pointed out the advantages of connecting the alternator to a steam turbine.

The pressure from the generator is stepped up to 25,000, 50,000 or even 100,000 volts by stationary oil transformers similar to those designed for commercial use at the present time. The high-voltage current then charged a series of oil condensers, which discharge their stored-up energy through the oscillator system of the transmitter by means of the disruptive discharge. This type of transformer has, it must be admitted, some inherent weaknesses, the most serious being the tendency of high-frequency currents to flow back into the transformer coils and so burn them out, and electrostatic stresses become so intense that disruption of the insulation is sometimes effected. These difficulties may be largely removed by inserting choking coils and an intervening plate of metal between the transformer and the spark-gap. This system of transforming currents is based on sound mathematical reasoning, and it is only a question of time when the induction coil will become past history, except perhaps for purely experimental purposes or in isolated places where such an equipment may be more cheaply installed. This gives our synthetic system two additional components, namely, an alternating-current generator and a transformer.

It is well known that a disruptive discharge in free air has the effect of greatly damping electric oscillations in an open-circuit radiator. To overcome this difficulty many schemes have been tried, such

as causing the spark to pass in partial vacuo, in gas et cetra; Fessenden has found that when the spark takes place in air compressed to a certain critical value which is practically 80 pounds to the square inch, the radiation per length of spark becomes proportional to the energy applied; or in other words, by decreasing the spark-gap and increasing the potential at which sparking takes place its radiation efficiency is greatly enhanced.

The apparatus for obtaining a compressed-air spark-gap comprises an air chamber connected to an air compressor. The base of the air cylinder serves as one electrode of the spark-gap, and a metal rod insulated by a sleeve of vulcanite acts as the complementary terminal. This device should prove a worthy adjunct to the proposed synthetic transmitter, and in lieu of the spark-gap it will be appropriated for our purpose.

The question now confronting us is whether our synthetic transmitter is to have tuned or non-tuned circuits. If an untuned system is chosen, all that is required is to run two or more vertical wires in the air a couple of hundred feet and suspend them from a mast. It has, however, been repeatedly shown that when an internal closed circuit and its complementary radiator system have the same electrical dimensions, and, therefore, their natural periods of oscillations are equal, there is a marked improvement in the operation of the emitter since a greater amount of energy is conveyed from the closed to the open circuit. This is the object of tuning the circuit without regard to selectivity.

Prof. Braun has supplied us with a beautiful example of tuned systems, the tuned circuit of which is formed by connecting a pair of variable capacities, made of miniature cylindrical condensers, in a loop having the primary of a small high-frequency transformer included in its circuit and acting as an inductance. The open-circuit or radiator system consists of one or more aerial wires brought to a common terminal at their lower ends, where they connect with one of the wires of the secondary of the transformer; the opposite free end of the latter is attached, if we follow Braun's specifications, to an artificial earth or a cylindrical capacity, but it would perhaps be better to lead it to a good earth.

Summed up, then, we have a transmitter comprising the following parts: (1) A motor, (2) an alternating-current generator (after Fleming), (3, 3′) choke coils (De Forest), (4) sheet-metal screen, (5) Morse key (De Forest), (6, 7) transformer (Fleming), (8) compressed-air spark-gap (Fessenden), (9) oil condensers, (10) adjustable condensers (Braun), and (11, 11′) oscillation transformer (Braun).

It would seem an easy matter to evolve a synthetic receiver on the lines of the complementary transmitter described, since such a device would not entail nearly as many parts, its functions would be fewer in number, and its operation more simple. While these premises are true, there are some commercial factors which must be taken into consideration, however, rendering the combination of all the desirable qualities exceedingly difficult unless we include some especially undesirable ones.

The ideal wireless telegraph receiver is one that operates with (1) a minimum amount of electromagnetic energy, (2) accuracy of record, (3) speed in reception, (4) minimum number of parts, (5) simplicity of adjustment, and (6) giving a written record of the message.

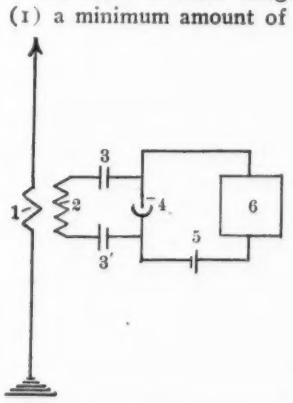


FIG. 2.—SYNTHETIC RECEIVER.

If a detector of the regulation silver filings coherer type is employed, then all the good qualities of accuracy, speed, ease of adjustment, etc., are thrown to the four winds; but in many cases all these lost qualities are amply compensated for by the permanent record resulting from the use of the Morse register. Much has been said and written about the good and bad qualities of the coherer, but if the tests made by the United States Navy count for anything, its status has been established pretty thoroughly; for after testing all the available detectors—this does not mean all of those invented—with their apurtenances for the conversion of electric waves into the alphabetic code, the Navy decided to adopt the Slaby-Arco system, in which the coherer and register are utilized.

A wireless telegraph receiver of this type comprises a resonator for the accumulation and transformation of electric waves into electric oscillations, a wave detector for varying the resistances of an internal circuit, which includes a cell and the windings of a sensitive relay. A second circuit actuated by the lever of the relay includes a source of e.m.f., a decoherer and a Morse register.

The normal resistance of the coherer is generally fixed before it leaves the factory, yet nearly all are made with a V-shaped pocket formed by the terminal conductor plugs, and the operator may adjust the slit to obtain a maximum and a minimum resistance. The polarized relay is subject to adjustment by means of a single milled screw projecting outside the case of the instrument. The tapper and the relay, while requiring but little attention in themselves, need looking after occasionally.

Prior to the reception of a message and at intervals between the working of the key and switching the aerial from the sender to the receiver, the "buzzer" keeps the operator busy in ascertaining and maintaining the adjustment between the relay, coherer and e.m.f. employed. Looking toward the elimination of the constant source of worry such a scheme involves, several systems have been devised wherein the variable coherer has been discarded as well as the relay, tapper and register. And "there's the rub," for if the former are to be done away with, then the means for imprinting the message must also be foregone, and the question as to how to get rid of the undesirable appliances by which accuracy and speed would be gained and to have and to hold the Morse inker, are problems which have as yet not been satisfactorily solved.

By Lodge's method of using the rotating mercurial coherer and the syphon recorded, we are near it, but the syphon recorder is quite a complex instrument which likewise must be handled with kid gloves. The scheme of providing an autocoherer or autodecoherer with a pair of head telephone receivers is the American inventor's idea of a swift, certain and simple receiver; but while the art will in time be perfected to such an extent that this practice will become general, the time is not yet ripe for its universal adoption owing in a large measure to the untoward influences of atmospheric electric charges and the fact that other systems are constantly "breaking in on the wire."

In our synthetic receiver, then, there are two alternatives, and the purchaser of wireless apparatus simply "pays his money and he takes his choice," as the colored gentleman expresses it. He can have an autodetector connected to a syphon recorder and submit to the conditions its intricacies impose upon his operator; or he can use the same kind of a detector connected to a pair of telephone receivers and submit to the caprices of the weather and receive consequently dots and dashes that Nature projects through the "ambient ether," and which cannot be deciphered; in either case he will have trouble enough.

These being the facts in the case, it is well to look over the field of detectors and select the best one, if possible, for the receiver. Prof. Fessenden's liquid baretter seems to represent the acme of perfection in detectors, since it is always in adjustment, the direct action of a disruptive discharge in its immediate proximity does not affect it in the least, and its range of resistance variability is sufficiently wide to permit the operation of a syphon recorder with it.

Using the liquid baretter in combination with a pair of telephones, a cheap and marvelously efficient receiver is produced, but the writer would advise the former type—the liquid baretter with the Lodge-Muirhead syphon recorder. If a non-tuned and non-syntonic receiver is desired, then the aerial and earthed wires may be connected to either side of the detector; but if a resonant receptor is desired, an arrangement like that shown in the diagram (Fig. 2) may be employed, where 1 is the primary of a small transformer connected in series with the aerial and earthed wires, 2 the secondary of the said transformer, which also acts as an inductance coil, 3, 3′ adjustable condensers of the mica and tin-foil type, 4 a liquid baretter, 5 a dry cell, and 6 a syphon recorder.

The synthetic transmitter and receiver evolved in the foregoing description would appear to contain all the essential improvements of all the workers in wireless telegraphy, and the combination we could expect if all the various companies now operating were brought together and a wireless trust effected.

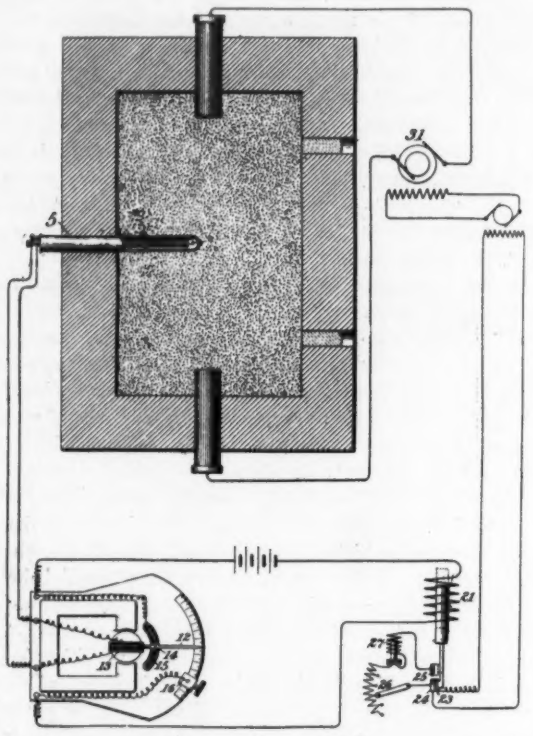
Dutch Pacific Cable.

A company has been formed in Cologne to lay a cable from the Island of Celebes to connect with the Commercial Pacific cable at Guam.

Recent Electrochemical Developments.

CONTROL OF THE TEMPERATURE OF ELECTRIC FURNACES.

A patent granted on July 12 to Woolsey McA. Johnson refers to a method of controlling the temperature in an electric furnace. In Fig. 1 a furnace of the resistance type is shown, the electrical energy



JOHNSON ELECTRIC FURNACE CONTROL.

being supplied from dynamo, 31, to two electrodes. Inserted in the furnace is the pyrometer, 5, of the Le Chatelier type, connected to a galvanometer with a movable coil, 13, the needle, 12, indicating on a graduated scale the temperature within the furnace. This needle is made of platinum and is insulated from the movable coil, 13. It is provided with the metallic contact, 14, which dips into mercury, 15. The second contact, 16, which is also made of platinum, is secured to a movable block, which is placed on that point of the galvanometer scale which corresponds to or slightly exceeds the temperature desired in the furnace.

As the furnace temperature rises to this degree, the needle, 12, makes contact with the point, 16, thereby completing a circuit in which is inserted a battery and the solenoid, 21, which attracts a soft iron core, shifting the contact, 23, from 24 to 25, thereby introducing into the field of the exciter the variable resistance, 26, and the electromagnetic cut-out, 27. These devices are so constructed and adjusted that the electromagnetic cut-out will break the circuit only in case the resistance proves insufficient to reduce quickly the furnace temperature.

PRODUCTION OF FERRO-VANADIUM.

A patent granted on July 12 to Gustave Gin relates to a process of manufacturing ferro-vanadium by electrolysis. As cathode, a fused bath of metallic iron is used, while the anode consists of an intimately conglomerated mixture of trioxide of vanadium and of carbon and the electrolyte of sesquifluoride of iron dissolved in melted fluoride of calcium. Fluorine is set free at the anode and attacks the trioxide of vanadium, which yields its oxygen to the carbon with formation of trifluoxide of vanadium. The fluoride of vanadium thus brought into solution in fluoride of calcium undergoes electrolytic decomposition. The cathode action is that vanadium is set free and alloys with the fused metallic iron at the cathode. The anodic action is the liberation of fluorine, which forms a fresh quantity of fluoride vanadium. The ferric fluoride thus only serves to prime the operation.

The anodes are made as follows: Trioxide of vanadium is prepared by calcining vanadic acid in presence of carbon, and is then mixed with a suitable proportion of finely powdered retort coke. Then an addition of hot tar is made so as to obtain a plastic paste which, after being malaxated, passes into a mill wherein it is crushed. It is then pounded under stamps and formed by hydraulic pressure into electrodes, which are baked, safe from contact with air, in furnaces of a high temperature.

BATTERY INVENTION.

The problem of producing electrical energy direct from carbon has for a number of years been highly attractive to electrochemical inventors, since success in these attempts would well recompense the work done. Our ordinary method of generating electrical energy from carbon with the aid of the steam engine and the electric generator represents an extremely roundabout procedure, of very low efficiency. The chief fault lies in the steam engine, the efficiency of which is limited by the principles of thermodynamics. What electrochemists have intended to substitute for this roundabout method has generally been the so-called carbon cell. The intention was to devise a cell of the general type of primary cells, but with carbon substituted for zinc. The reaction which was aimed at was the combination of the anodic carbon with oxygen during the discharge of the cell. This is, of course, chemically the same reaction as if we burn coal under boilers, but in the latter case we get the chemical oxidation energy of carbon in form of heat and must then change the heat into electrical energy, and this latter change is necessarily of low efficiency. If we had a carbon cell the combination of the anodic carbon with oxygen would not generate heat, but directly electrical energy, and the efficiency would be high. Various inventors have worked in this direction, but without success.

Attempts have then been made to solve the problem in another way. The intention was to devise a primary battery of such materials that the materials produced during discharge can be brought back to their original form (representing the charged condition of the battery) with the consumption of no other materials but carbon and atmospheric oxygen. The carbon here is not burned so as to produce heat, but for the purpose of reducing the material oxidized during the discharge of the battery. Perhaps the simplest example of such attempts would be the application to an "oxygen-lift cell," like the Edison nickel-iron battery—although this scheme was never applied to this battery in practice. As is well known, the Edison battery consists, in its charged condition, of active materials of nickel oxide and iron as electrodes, in potassium hydroxide as electrolyte. During discharge the electrolyte is not changed. The nickel oxide is reduced and the iron is oxidized. If we could now take out the active materials from the cell and oxidize the reduced nickel simply by combination of the nickel with atmospheric oxygen and could also reduce the iron oxide simply by treatment with carbon without great expense, the plates would be brought back to their original condition and nothing would have been consumed but atmospheric oxygen and carbon. The plates could then be placed again into the cell and the cell could be discharged again.

Along these latter lines of research, Mr. H. Jone, of Chicago, has been working for several years and his cell was, for some time, exhibited quite sensationally in the daily newspapers. It was also described later in technical journals (see Digest, ELECTRICAL WORLD AND ENGINEER, December 5, 1903, page 932). In an article in *Electrochemical Industry*, January, 1904, Mr. C. J. Reed has critically discussed Jone's cell; he thinks that the enormous labor of handling the different materials during the various stages of Mr. Jone's process, the mechanical losses and the losses of energy, would appear to be prohibitive.

A patent has now been granted on July 12 to Mr. Jone. His battery is a primary cell of the ordinary alkaline type, in which metallic tin is substituted for metallic zinc. The reason is that it is easier to reduce tin from its oxides than zinc. The tin forms the anode, while the mercuric oxide is the cathode, acting like a depolarizer in other primary cells. The electrolyte is hot caustic potash. Stannite of potassium is obtained in solution, and the stannous oxide contained therein precipitated as stannite of barium by addition of barium hydroxide in aqueous solution. The stannite of barium is heated with coal or carbon monoxide and the tin reduced in a furnace according to methods similar to those used ordinarily in the reduction of tinstone, except that the hot gases issuing from the furnace are used to heat the cell or a battery of several cells. The reduced tin is again used in the cell for the generation of an electric current.

The mercuric oxide is reduced to mercurous oxide by the action of the cell. This mercurous oxide is removed and converted into mercuric nitrate by treatment with concentrated hot nitric acid. The nitrate is broken up by heat, yielding mercuric oxide, which

is again used in the cell as depolarizer, and lower oxides of nitrogen, from which nitric acid is recovered by oxidation. The heat of the furnace gases generated in the process is used for heating the cells, like that of the gases of the reduction furnace. The apparatus used for the process is described in detail.

The first claim reads as follows: "The method of generating electrical energy, which consists in first combining a metal, the oxide of which yields chiefly carbon dioxide in addition to the metal in its reduction by carbon, as the positive plate with an alkali as the electrolyte in a galvanic cell, generating electrical energy by oxidation of the metal, and then reducing that battery product which contains the metal oxidized in the battery reaction to the metal by means of the oxidation energy of fuel, and repeating the oxidation of the metal with generation of electrical energy."

A patent granted to Isidor Kitsee refers to a peculiar construction of storage battery plates. The plate is contained in a frame having a middle compartment filled with electrolyte and two outer compartments filled with active material. The active material is enclosed within porous plates and within the active material pins are provided around which conducting ribbons are wound in a circuitous manner through which the current passes to the outside terminals.

A patent granted to T. A. Willard refers to a non-conducting sheath for enveloping a storage battery plate. This sheath is perforated and the special feature of the device is that the perforations are cone-shaped, the larger openings being on the inside of the sheath.

Two patents granted to C. B. Schoenmehl refer to mechanical details of the construction of a primary battery with zinc as one electrode and copper oxide scale as the other electrode and an alkaline electrolyte. One patent refers to the receptacle for holding the copper oxide. It is a basket of circular cross-section having exterior perforated tapering side walls, so that the receptacle is larger at its top than at the bottom. In his second patent the inventor provides within this receptacle a central chamber with perforated side walls, so that the solution has more access to all parts of the depolarizer.

P. J. Kamperdyk patents the construction of a zinc electrode for primary batteries. The electrode is in form of a flat plate of zinc, and to strengthen its construction it contains a skeleton of platinum-plated copper wire connected to the terminal of the cell.

New Telephone Patents.

SELECTIVE RINGING.

The biased bell is now much used for selective ringing and is quite satisfactory in many cases. Sometimes, however, conditions are such as to render good working adjustment very difficult to obtain. This is because of the peculiar construction of this type of bell, wherein the forward stroke of the bell hammer is in response to the magnetic effects of the ringing current from the central office, while the return stroke is affected by spring power. This latter pull must, of course, be overcome on the forward stroke and the spring tension must be set within the limits of the pull of the actuating currents. Furthermore, the biasing spring tension must be reasonably strong, as the stroke upon one gong is due solely to it. It is the proper balancing of these forward and backward forces which become difficult. In order to avoid this difficulty, Mr. T. C. Drake, of Malta, Ohio, has developed a system in which the return stroke is produced by a current impulse acting with the bias. In his system the weight of the bell hammer serves as sufficient bias. A 90-volt current impulse causes the forward bell stroke against this bias, while a reverse 30-volt impulse acts with the bias to cause the return stroke. The current impulses are obtained from an ordinary ringing generator of 60 volts in series with a properly poled battery of 30 volts. The result is an alternating current transposed with reference to the line of zero potential.

Mr. Drake has also patented a corresponding generator and battery arrangement for use with a two-wire, common battery switchboard, with which difficulty has hitherto been experienced during selective ringing because of the de-energization of the cut-off and on relay. By using his combination of direct and alternating current, there is at every instant a current supply available for actuating the relay.

Still another selective system patent is one granted to J. T. Fisk, of Adrian, Mich., which describes a step-by-step system. It is the inventor's idea to produce a system wherein the selective switches may be returned to the zero position without resort to changes in current strength or polarity, but shall return automatically with the return of the receivers to the hooks. A further object is a reduction of the number of magnets at each station to one. The operation of the system is akin to that of similar step-by-step systems.

AUTOMATIC STATION GENERATOR.

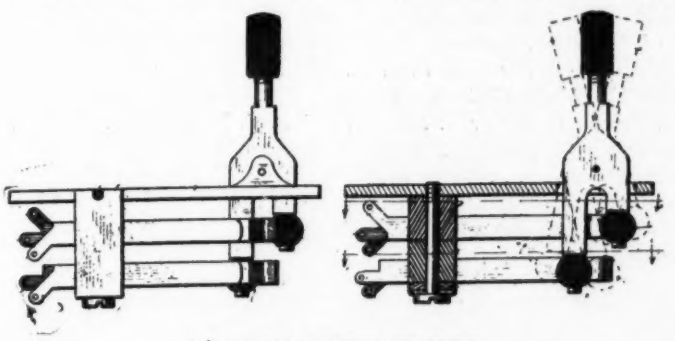
Messrs. J. W. Mead, H. A. Mackie and M. Van Buren, of Amsterdam, N. Y., have jointly invented an apparatus for signaling for use with the magneto system. It provides that the mere removal of the receiver from the hook at any station shall throw the line drop at the central office. To accomplish this result auxiliary contacts are mounted upon the hook switch so that as the hook rises an induction coil equipped with a vibrator has its primary circuit closed and its secondary connected to the line. The alternating current from this coil throws the drop.

TRANSMITTER.

A granular-type transmitter forms the subject of a patent granted to Dugald C. Jackson, of Madison, Wis. The general construction approaches the "solid-back," but the front electrode backing is made piston-shaped and oscillates within a felt ring packing.

COMBINED RINGING AND LISTENING KEY.

A combined ringing and listening key, the design of W. E. McCormick, of Chicago, is shown in the cut, which is practically self-



M'CORMICK CIRCUIT CHANGER.

explanatory. The upper key element is for ringing and the lower for listening. Mr. McCormick has assigned his patent to the International Telephone Manufacturing Company, of Chicago.

CURRENT NEWS AND NOTES.

WIRELESS TELEGRAPHY ON THE HOLLAND LINERS.—The Holland-American Line announces that it has contracted with the Marconi Company for wireless telegraph equipment for its twin-screw steamers plying to the Low Countries from New York, etc.

THE MARCONI COMPANY AND THE GOVERNMENT.—It is stated that the Marconi wireless telegraph station at Siasconset, Mass., has been discontinued, the United States Government having refused to permit the continuance of the station on the South Shoals Lightship. It is believed that the Government will install wireless telegraph equipment of its own at both of these stations.

SHELL TYPE TRANSFORMER INSULATION.—An objection which has been urged against the shell type of transformer in comparison with the core type is based on the inability properly to insulate the sharp inner corners of the flat coils necessary with the former type of construction. It is a matter of record that the major portion of shell type transformer failures has been due to weakness at this point. To provide means for eliminating trouble from this source is the object of a patent issued July 19, 1904, to O. B. Moore and assigned to the Westinghouse Electric & Manufacturing Company. The invention resides in a novel method of forming the corner piece for flat coils, which piece consists of insulating material bent to form a channel piece and folded to form a sector-shaped double plait extending approximately radially from the center of the coil. The arrangement is such that excessive bulging at the corners is prevented, while the material is continuous as far as concerns insulation.

AUTOMATIC MOTOR CONTROLLER.—To provide means for varying automatically and at a proper rate the resistance inserted in the armature circuit of a shunt-wound motor during the starting period is the object of a patent issued July 12, 1904, to George H. Whittingham. The inventor subdivides the resistance and arranges to cut out the divisions by short-circuiting devices operated by the current supplied to the motor. For this purpose he used electromagnets interlocked electrically, so that they must close in the proper sequence, each one being retarded in its motion by the magnetizing effect of the current flowing to the magnet first to be operated. The length of time required to reverse the magntism in an iron core is depended upon to furnish sufficient time lag between the short-circuiting of the several divisions of the starting resistance in order to give uniform acceleration to the motor and to limit properly the current taken by the armature.

CONGRESS OF ARTS AND SCIENCES.—One of the numerous international Congresses at St. Louis this year is that of the Arts and Sciences, September 19 to 25, inclusive. One of the departments of the Congress is devoted solely to technology. Chancellor Chaplin, of Washington University, is its chairman, and the speakers who will discuss the general subject of the department are Prof. H. T. Bovey and Mr. John R. Freeman. It is subdivided into six sections. President Humphreys, of Stevens Institute, will be chairman of Section B, on mechanical engineering, and the speakers will be Prof. A. Riedler and Prof. A. W. Smith. The chairman of Section C, on electrical engineering, will be Prof. A. E. Kennelly and the speakers Signor G. Marconi and Prof. M. I. Pupin. Section D, on mining engineering, will be presided over by Mr. John Hays Hammond, and the speakers will be Prof. R. H. Richards and Prof. S. B. Christy. Section E, on technical chemistry, will have Dr. C. F. Chandler as chairman and Prof. O. N. Witt and Prof. W. H. Walker as speakers.

COMBINED STARTER AND REGULATOR FOR ELECTRIC MOTORS.—A patent issued July 12, 1904, to Edward T. Moore describes some interesting mechanical details by means of which a motor used for intermittent service may be controlled electrically, according to the condition of the apparatus to be supplied with power. The operation is described in connection with an organ blower, to control the motor for which the combined starter and regulator is especially applicable. The regulator, or rheostat, differs from the ordinary type in that the no-resistance position is found when the arm has completed approximately one-third of its travel. Throughout the remaining portion of the travel, resistance is again placed in circuit, and, when the arm has reached the end of the rheostat, the circuit to the motor is completely opened. The position of the arm is determined directly by the amount of air contained in the bellows, so that when the main switch to the motor is closed the regulator automatically starts, accelerates, controls and stops the motor, and at all times, without further attention, maintains a proper supply of air within the bellows.

ALTERNATING-CURRENT TRACTION.—For the purpose of facilitating the operation of series alternating-current railway motors, Mr. C. F. Scott, according to a patent issued July 19, 1904, proposes to arrange means whereby the amount of current flowing through the armature may be made different from that in the field coils, while maintaining a value proportional thereto, and thus permitting the machine to retain the advantageous series motor characteristics. To accomplish this result the inventor uses variable-ratio series transformers or auto-transformers for one or both of the motor circuits. By this means the current in the armature may be made relatively high and the voltage low, conditions favorable to commutator operation. A further advantage is found in the fact that by the use of one series auto-transformer for the armature circuit the regulating transformer for the complete motor equipment may be of the single-coil type, operated at the line voltage, and having intermediate taps for starting purposes, thus reducing the cost below that required for a two-coil lowering transformer, and allowing the motor to be operated, when at full speed, directly from the line, the starting transformer then being disconnected from the circuit.

INDUCTION REGULATOR FOR ALTERNATING-CURRENT SERIES MOTOR.—An advantage possessed by the alternating-current motor over the machine of the direct-current type is due to the ability to obtain voltage regulation without the use of the uneconomical starting resistances necessary with the latter machine. Voltage adjustment may be secured by the use of variable-ratio transformers or induction regulators. The latter type of regulator gives uniform change of voltage and is free from sparking at the controller tips. A patent issued to B. G. Lamme July 19, 1904, relates to a method of connecting such induction regulator in circuit with his well-known compensated series motor. The induction regulator has its primary winding connected in shunt to its secondary winding and to a portion of the coils of an auto-transformer, which is placed directly across the supply lines, one lead of the motor being tapped at the junction point between the regulator windings and the other connected to the supply lead. By reason of this arrangement, under running conditions, a portion of the current taken by the motor flows directly through the primary winding in shunt to the secondary of the regulator, thus permitting the regulator to work at a relatively low degree of induction and at a reduced current.

PRESSURE-CONTROLLED SWITCH.—The problem of producing a satisfactory mechanical pressure-controlled electric switch seems recently to have received considerable serious attention on the part of inventors. A solution of the problem as found by H. H. Cutler forms the subject of a patent issued July 19, 1904. The pressure-actuated mechanism in external appearance resembled the old type scale-beam boiler safety valve, while the details are similar to those of the pressure controller employed for limiting the supply of gasoline to the furnace of steam-driven automobiles, consisting of a fluid-tight diaphragm arranged to operate a weighted lever when the fluid pressure exceeds that value at which the mechanism is adjusted. The motion of the lever opens or closes a snap-acting switch in the circuit to an electromagnet. The electromagnet, with proper damping dash-pot, operates the rheostat of the main driving motor. When the rheostat arm has completed its working stroke a short-circuiting switch is opened and resistance is introduced into the motor leads, thus limiting the increase of fluid pressure by decreasing the speed of the motor. To an extent seldom seen in patent office literature the specifications and drawings describe and illustrate the apparatus in a form suitable for commercial use, while the fact that 31 broad claims have been allowed would seem to indicate that the value of the patent had not been decreased by reason of its clearness and definiteness.

ASYNCHRONOUS MOTOR.—Improvements in the efficiency, ventilation and starting performance of asynchronous motors form the objects of a United States patent issued July 12, 1904, to Paul Jigouzo, of Vanves, France. In order to increase the efficiency the inventor would make the primary the stator and place it within a rotating squirrel-cage wound secondary, thus decreasing the amount of core material subject to alternating flux and lessening the length of the inactive part of the primary conductors. Improved ventilation is secured by use of an open structure with forced air circulation using fans on the revolving member. Starting performance is improved in a manner much simplified (?) in comparison with the commercial scheme which uses resistance in the secondary circuit, by providing, in addition to the working primary coils, one (and perhaps three) additional sets of primary coils, having relatively large number of turns, to be energized only during the starting period and which result in a reduction of the magnetizing current. The inventor evidently wishes to change the number of poles during starting. According to his diagram, however, both the starting and the main operating coils are left in circuit when the connections are for best running condition, the latter directly and the former through certain resistances, the effect of which arrangement when a squirrel-cage secondary is used can well be imagined. The claims are restricted to the details of construction embodying the inner stationary primary core and the outer revolving secondary core and the arrangements for providing ventilation.

TRUNKS BUYING TROLLEYS.—The purchase of trolley systems by trunk railroads is fairly well started. A Boston dispatch

now says: "In pursuance of the policy which the New York, New Haven & Hartford Company has pursued since it first purchased the Stamford line, of buying competitive electric roads, the company has, through the Consolidated Railways Company, purchased the New London Street Railway Company, the Norwich Street Railway Company and the Montville Street Railway Company. Payment was made for these companies in the fifty-year 4 per cent. debenture bonds of the consolidated companies. The underlying bonds are not to be disturbed. The New Haven Company now owns nearly all of the competing lines with the exception of those of the Connecticut Railway & Lighting Company, which is the strongest concern of its kind in the State, and is owned by the United Gas Improvement Company, of Philadelphia. It has frequently been reported that the New Haven Company was after the Connecticut Railway & Lighting Companies, and it is not improbable that it will in the end acquire that property. The New London road is now paying dividends at the rate of 4 per cent. per annum, the Norwich 5 per cent. and Montville road 6 per cent. The roads have no floating debts. They are capitalized for $650,000 bonds and $850,000 stock. Under the sale of these properties the underlying bonds will not be disturbed. The Consolidated Railways Company, of Connecticut, is capitalized for $10,000,000 stock and $1,500,000 50-year 4 per cent. debenture bonds, the latter being issued to take over the above three roads and also fund the floating debt of the Fairhaven road."

LETTERS TO THE EDITORS.

Originality in Burglar Alarms.

To the Editors of Electrical World and Engineer:

SIRS:—In reading over the July 16 number I was very much interested in your description of a fire, water and burglar alarm device invented by Mr. H. E. Vineing. It called to mind the truth of the old saw: "There is nothing new under the sun." In July, 1893, I was very much concerned how to protect my flat for two weeks, while I was at the World's Fair at Chicago. After considerable experimenting the following rig was put up: I placed a 4-in. bell on a board, put it out on the fire escape, covered it with a dishpan to protect it from the weather, and connected it with the contact piece in the bathroom. From the other contact piece ran a No. 60 black thread to a screw eye in the baseboard near the floor and directly across the front door. A movement either way of the middle contact of ⅛ in. started the bell ringing and warned the neighbors.

NEW YORK CITY. J. T. TAYLOR.

Tests of Machine Tools.

To the Editors of Electrical World and Engineer:

SIRS:—I began to read with considerable interest the recent article upon "Some Tests of Iron and Wood-Working Machinery," by Mr. Hines, but had not read very far when I found that it did not give the information I wanted to find. In order that data may be available to the best advantage, enough detail should be given to enable the working out of results into time and quantity rates. These may be expressed either as cubic inches of metal removed per minute or pounds of metal removed per hour.

Referring to the first item, the 84-in. wheel lathe, a feed rate is given, but it is not stated whether that feed was the one used throughout or not. Evidently it was not, as there is no uniform relation between the horse-power observed and the cutting speed.

Three items are mentioned as a light, medium and a heavy load, but with these no feed amount is stated. Had the feed rate been mentioned at these points it would have been easy to determine the relation between power required and amount of metal removed per minute or otherwise.

Referring again to the 84-in. lathe item, it will be noted that the maximum power required is given as 12 hp, and assuming two cuts of 5/16-in. x ⅛-in. feed each, the result is 15.6 cu. in. per minute of metal removed, or at the rate of .77 hp per cu. in. If the assumptions are correct, the showing is quite good for that class of metal. Some of the other tests also could be used to better advantage if more detail was given. Having noted the case of the lathe, the others will be readily seen.

Reference to the frog planer will show power used as 18 hp and metal removed at the rate of 18.5 cu. in. per minute, which results in about 1 hp for each cu. in. of metal removed. This is not at all bad for frog work, but the reference to the cut 22 in. wide is not quite clear.

The author of the article deserves credit for what he has done, and for his willingness to publish it, and we can sympathize with him when he speaks of his difficulty in securing accurate information. Hence, this brief note calling attention to points which, in our opinion, would make his contribution of still greater value, and we trust he will favor us with such data as will enable us to work out results as indicated.

NEW YORK CITY. M. E. MADISON.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

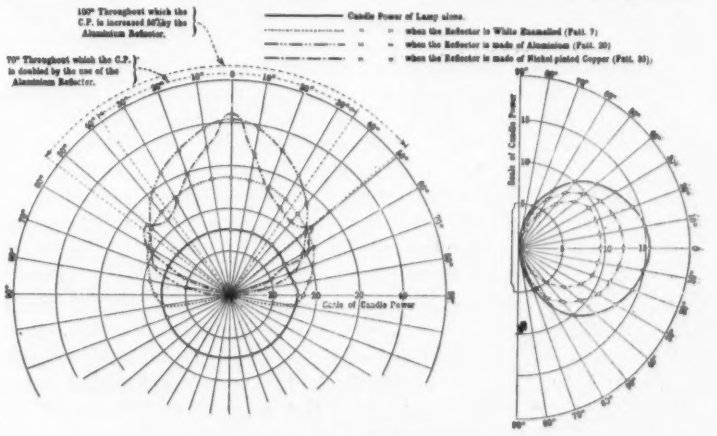
DYNAMOS, MOTORS AND TRANSFORMERS.

REFERENCE.

Induction Motor.—BESIG.—A mathematical article illustrated by diagrams. The Heyland diagram of the induction motor has become popular due to simplicity in the ideal case of a motor without losses. For application in practice it is, of course, necessary to take the losses into account. The author gives rules for applying in practice the diagram of the induction motor, for constant voltage at the terminals, according to Ossanna and Sumec, taking into account the primary voltage and current losses.—*Zeit. f. Elek.* (Vienna), July 10.

LIGHTS AND LIGHTING.

Photometric Tests of "Linolite."—An account of photometric experiments of Dow with the system of electric lighting called "Linolite." "The lamps are in the form of long, narrow cylinders, and these are connected end to end." Fig. 1 shows the distribution of light in a horizontal plane, the lamp, and, therefore, the filament, being vertical, with or without reflectors. The curves in Fig. 2 show the mean distribution of lighting any vertical plane through the filament, candle-power with one of the reflectors to the mean spherical candle-which is also vertical as before. The ratio of the mean spherical


Candle Power of Lamp alone.
when the Reflector is White Enamelled (Fatt. 7)
when the Reflector is made of Aluminium (Fatt. 20)
when the Reflector is made of Nickel-plated Copper (Fatt. 80).
100° Throughout which the C.P. is increased 80%by the Aluminium Reflector.
70° Throughout which the C.P. is doubled by the use of the Aluminium Reflector.
Circle of Candle Power
Scale of Candle Power

FIGS. 1 AND 2.—DISTRIBUTION CURVES.

power of the lamp alone enables one to calculate the efficiency of the reflector. The efficiency of a polished aluminum reflector is

81 per cent., that of a white enameled reflector 79 per cent., that of a nickeled copper reflector 69 per cent. In addition to being the best reflecting surface, aluminum has the advantage that it does not tarnish as nickel or silver-plated metal does. Where a strong illumination is wanted over a particular area, "linolite" is said to be better than ordinary incandescent lamps without reflectors.—Lond. *Elec.*, July 1.

REFERENCE.

Train Lighting.—Loppe.—An illustrated description of a method of train lighting based on his method of getting constant voltage from a dynamo if the speed is above a certain value (see the abstract above under dynamos). The dynamo furnishing the lighting current and the auxiliary dynamo which is inserted in the exciting current for the main dynamo, are both mounted on an axle of the train. As long as the speed is beyond a certain value, the lighting current is obtained from the dynamo. When the speed is below this value, the lighting current is supplied from a battery.—*L'Ind. Elec.*, June 25.

POWER.

Electric Power in a Harbor.—The conclusion of the illustrated description of the electric plant at Heysham Harbor. The electric cranes and capstans are described. There are a number of five-ton wharf cranes, the interesting part of which is the lifting gear. For this the "free barrel" arrangement has been adopted in which the lifting barrel is not keyed directly to the shaft, but runs loose upon it, being connected or disconnected by a "coil" friction clutch. By this means the lifting motor always runs in one direction and is never reversed. The barrel shaft carries the main spur wheel rigidly keyed on to it, and this spur wheel gears directly by single reduction with the pinion attached to the armature spindle of the lifting motor. The hand lever actuating the lifting controller also actuates the lifting solenoid, which controls the lifting friction coil clutch, the arrangement being such that on moving the lifting handle from the off position current is switched on to the solenoid, the clutch is put into gear and the lifting motor started simultaneously; after the clutch is in gear, further movement of the lever cuts out resistance and speeds up the motor. There are only two working handles, one for lifting and one for slewing, and there is a treadle for the mechanical brake, so that the working of the crane is as simple as that of a steam crane. One advantage of the "free barrel" arrangement is the large increase in speed of working both in lifting and lowering, and also the reduced liability of accident to the motors, owing to their being non-reversible, and the impossibility of suddenly stopping the armature. The great gain in speed is in lowering. The motor does not take excessive current in starting. A no-voltage release is added, so that the lifting drum is held and the controller thrown back should the supply fail for an instant. The system of current distribution and of lighting is also described. —Lond. *Elec.*, July 1.

Prime-Movers for Alternators Operated in Parallel.—Rosenberg. —A paper discussing the requirements which should be fulfilled in prime-movers driving alternators for operation in parallel. The phenomena taking place here are explained by mechanical analogies. The author gives the following equation, which he considers to be of great value: It is $q = 710\ jep\ T^2\ N/(n\ G\ D^2)$. Operation in parallel becomes impossible if q is equal to unity, or approximately so. All quantities in this formula can be easily determined and have the following meaning: j is the ratio of the short-circuit current to the normal watt current; it varies considerably according to the purpose for which the dynamo is used; it is mostly between 3 and 4.5, a fair average being 3.75. e is the efficiency of the dynamo, approximately 0.94; p is the number of pairs of poles; T is the duration of the cycle of the "pendulum force," and is equal to the double, single or half the period of revolution, according to the nature of the prime-mover; for a two-cycle gas engine, T is the time of revolution; for a single-cylinder steam engine it is one-half time of revolution; for a compound steam engine one-fourth time of revolution, etc. N is the output in horse-powers, corresponding to normal current; n is the number of revolutions per minute; $G\ D^2$ is the amount of inertia in kg. $\times$ meter^2.—From a reprint from the *Zeit. d. ver. deutsch. Ind.*, 1904.

TRACTION.

Surface-Contact System.—Shawfield.—A paper read before the (British) Mun. Elec. Assoc. on the commercial practicability of electric traction by surface contacts. His general conclusions are as follows: A well-designed and carefully-installed surface-contact system is superior to the overhead trolley system in respect to safety, reliability, disfigurement of streets and obstruction to traffic. The overhead system is considerably cheaper both as regards the capital cost of installation and the annual cost of operation and maintenance. For tramway systems where low initial cost and low annual charges are the first consideration, and especially for light railways in thinly populated districts, the overhead system is to be preferred. In many of the larger towns, and especially at watering places and other pleasure resorts, the surface-contact system has many claims for serious consideration in preference to the overhead trolley system. The author gives much detailed information concerning the surface-contact system of the Lorain Steel Company, which has been in operation at Wolverhampton on a line of 11½ miles single track. Seven more miles are now to be added. The only danger to safety is from the metal stud in the center of the track. Within twelve months a total of 109 boxes were found more or less alive, of which 59 were alive at an e.m.f. of over 50 and under 500 volts. The defects in 100 of these boxes were the result of damage done to the interior of the cups by heavy and repeated short-circuits, caused by pieces of scrap iron which were picked up by the magnet system and came in contact at the same time with the collecting skate and with a cross rail at junctions and turnouts. The effect of a number of short-circuits on any cup is that the interior of the top half of the cup becomes burned and charred, and thus looses its insulating properties. The degree of damage to the cup in the event of a short-circuit depends entirely upon the time element of the circuit-breaker controlling the main feeder. The author is now installing circuit-breakers with a rapid brake having magnetic blow-out and is sure that this will greatly reduce the number of defective boxes in the future. In only one instance in which a shock received from a live stud was attended with serious results, was when a sheep and a dog were electrocuted when treading on the faulty box. He thinks that horses are less sensitive to a shock sustained by stepping on a charged metallic surface than to a shock received from a live conductor falling on them from above. Since with overhead systems there is danger from a fallen trolley wire, from a fallen telegraph or telephone or guard wire, and from a pole which has become alive through the failure of insulators, he concludes that concerning safety, the balance of advantage lies with a well-designed and carefully-installed surface-contact system. Concerning reliability of operation, he states that in spite of heavy snowfalls during February and March the total number of car miles lost due to defects of electrical equipment of both cars and tracks averaged 3⅓ car miles out of over 10,000 run in a whole year. He remarks that the surface-contact system is equivalent to an underground trolley wire divided into 10-ft. sections, each of which is independent of the rest. Any faulty boxes can be removed and replaced by a new one in an average time of 15 minutes without any interruption of service. He emphasizes that the Wolverhampton system is fool-proof, inasmuch as it is practically beyond the power of the motorman to inflict damage thereon by careless or incompetent handling of his car. Concerning the cost of operation and maintenance, he admits that no system of electric traction can rival the overhead trolley system. With the surface-contact system, there is an increased consumption of electrical energy, due first to the energy required to operate the circuit-closing mechanism of the track equipment; second, due to the extra weight of the apparatus carried on the car, and third, due to surface leakage from box to rail over the paving under each car on the track. In Wolverhampton the total additional current consumption to be charged against the surface-contact system is approximately 19 per cent. in excess of what would have been required by the overhead trolley system. Concerning cost of installation he points out that the cost of the trolley system is practically the same for either double or single track, while the cost of the electrical equipment of a surface-contact system is twice as much for double-track as for single. He estimates that first-class overhead construction costs from $7,500 to $10,000 per mile of road, whether double or single-track, whereas the cost of a surface-contact system will be from $10,000 to $12,500 per mile of single track. In the discussion which followed, Rider criticised strongly the surface-contact system and thought that if Wolverhampton suffers from scrap iron so much it was just the wrong place to put down a surface-contact system. Somebody in that town had told him that he liked the surface-contact system very much, for the reason that

the service was the quickest in the country, because all the horses and carts kept off the track. Wetmore advocated the surface-contact system, stating that the failures in Paris, which had given it a bad name, were due to the use of mercury in the Diatto system employed there and to the insufficient strength of the top cover of the contact box. In an editorial note on the paper it is said that while the system of the Lorain Steel Company has proven the best that has been put into operation for a lengthy period of time, and while the surface contact is not so bad as its reputation, yet it has not sufficient advantages over the trolley system to warrant an expenditure upon it of more than double the capital and an increase of 19 per cent. in the cost of working.—Lond. *Elec.*, July 1.

Interurban Railway.—An illustrated description of the Cleveland, Painesville & Ashtabula Electric Railway, which has a length of 29 miles, and connects New York State across the northern part of Ohio with the interior of Michigan. At the power house three-phase currents at 13,200 volts and 25 cycles are generated, the average output of the station being 4,500 ampere-hours per day, which includes current for lighting. The cost of current, including all overhead expenses, has been brought down to very nearly 1 cent. per kw. There is a 360-kw rotary converter located in the main station and also a converter at Geneva, besides two portable sub-stations.—*St. R'y Jour.*, July 16.

REFERENCES.

Car Terminal.—An illustrated article on a new car terminal at Norumbega Park, a pleasure ground about 15½ miles from Boston. It is owned by the Boston Suburban Railway Companies, which have erected a theatre at the park, no charge being made for passengers of the trolley line.—*St. R'y Jour.*, July 9.

Repair Shop.—A fully-illustrated description of repair shop practice of the Columbus Railway & Light Company in Columbus, Ohio.—*St. R'y Jour.*, July 9.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Polyphase Sub-Stations.—PEARCE.—An abstract of the paper read before the (British) Mun. Elec. Assoc., on the design of polyphase sub-stations. Taking a 6,500-volt, 250-kw machine as an example, the costs of an induction motor-generator, a synchronous motor-generator and a rotary converter (exclusive of its stationary transformers) are given as $30.50, $27.50 and $19 per kw, respectively, the floor space occupied by the rotary being also considerably less. After detailing the various methods adopted for starting rotaries and synchronous motor-generators, he described an alternative method in which a compensator is used to reduce the main voltage by 50 per cent., and the decreased voltage is employed for starting, the machine being switched over from the half-voltage to the full-voltage bus-bars when it attains full speed. He recommended rotaries at 25 periods for traction, synchronous motor-generators at 50 periods for mixed lighting and traction, and for a continuous-current lighting and power system, as a rule, some synchronous and some induction motor-generators. In the discussion Ruthven-Murray said that he had found that the reputation for want of stability of rotaries is not justified. Rider expressed his strong preference for induction motor-generators. Ferranti deplored the increasing complication in distributing systems and thought that we should return to simple single-phase working. Wordingham expressed his surprise at differences between the cost of using three single transformers and a three-phase transformer, viz.: $7 per kw in the former case and only $4 in the latter case for oil-cooled transformers. Hadley mentioned the noise made by induction motor-generators as a disadvantage. Pearce stated that the all-day efficiency of his sub-stations at Manchester is from 75 to 76 per cent.—Lond. *Elec.*, July 1.

Efficiency of Switchboards.—A note on an investigation made by Boje on the various losses observed in the switchboards of a small station comprising two 80-kw, direct-current dynamos, one 160-kw dynamo and two accumulator batteries, the distribution being on the three-wire system at 2 × 110 volts. The chief sources of loss are the voltmeters, fuses, ammeters and switches. The first switchboard, serving one of the two 80-kw dynamos, passed energy to the amount of 74,948 kw-hours during a year, the loss in this time being 75.9 kw-hours. The efficiency, therefore, comes to 99.89 per cent. Smaller efficiencies were observed for the switchboards of the other machines, the lowest being that of the accumulator switchboard during charge, which was 98.84 per cent.—Lond. *Elec.*, July 1.

REFERENCE.

Switch.—A short description, with detailed drawings, of a switch for cutting in or out a number of lamps, etc., from a distance. This is done by means of an electromagnetic device. The switch is made by the Siemens-Schuckert Company.—*Elek. Bahnen*, No. 11, June.

WIRES, WIRING AND CONDUITS.

Perforation Voltage of Cables.—KATH.—A long paper in which he first calls attention to the following experiment: If a cable is made which, according to former experience, should break down at 10,000 volts, and if it is cut in two small pieces, each of one meter length, and if each piece is then tested separately, perforation voltages are obtained varying between 10,000 and up to 100,000 volts. The average is certainly many times higher than what one would expect to be the perforation voltage of the cable. In testing a large number of short pieces of a cable, with different thicknesses of insulation, but of equal length, the perforation voltage was found by the author to be proportional to the thickness; only for small thicknesses the perforation voltage was a little higher than corrsponds to this rule. This does not agree at all with Baur's law, according to which the perforation voltage should be proportional to the two-third power of the thickness. But Baur used for the lower voltages short pieces of cable and for the higher voltages longer cables. The author considers this to be an unjustified procedure. He describes a series of experiments and develops a preliminary theory of the subject. The main result is that by tracing a single source of error, i. e., the non-uniformity of the paper used for insulation, all phenomena of the perforation voltage can be explained. The non-uniformity of the paper is not due to single bad points in the same, but is due to the ordinary superposition of the fibres. Since the use of strong fibres is necessary for good paper, the only means for getting a high perforation voltage is to take the greatest possible care in impregnating the paper. It is possible to conclude from tests with short pieces what will be the perforation voltage of a longer cable length. The paper is concluded by a mathematical development of his theory.—*Elek. Zeit.*, July 7.

ELECTRO-PHYSICS AND MAGNETISM.

Penetrating Radium Rays.—MCCLELLAND.—A paper on the question as to the nature of the very penetrating, or γ rays, given out by radium, whether they are electromagnetic pulses like Röntgen rays, or a flight of charged particles like the α and β rays. In some respects the γ rays are like the α and β rays, which we know to consist of charged particles; while on the other hand no deflection of the rays in a magnetic field has been detected; and, further, we should expect to get Röntgen rays from a body like radium which is emitting charged particles traveling with great velocity. The chief reason for considering the γ rays to consist of charged particles lies in the fact that the absorption of these rays by different substances is approximately proportional to the density of the substance, a law obeyed by α and β rays and by cathode rays, but not obeyed by Röntgen rays. However, Eve has recently found that when only very penetrating Röntgen rays are used, the absorption produced by different substances becomes more nearly proportional to the density of the substance. The author has made some experiments to detect directly the charge carried by the γ rays, if there is any. The author could not find such charges and he thinks that the weight of evidence is certainly in favor of the γ rays being similar to Röntgen rays.—*Phil. Mag.*, July.

N-Rays.—LEROUX points out the important part played by subjective effects in many of the usual N-ray observations. Blondlot agrees with Becquerel's theory of the action of N-rays on a calcium sulphide screen. This theory maintains that the sulphide absorbs the N-rays and emits secondary N-rays, which, reaching the eye together with the light, increase the sensitiveness to the retina and produce the appearance of greater luminosity. This theory accounts for the failure of all the attempts to record photographically a change of luminosity of the screens. The author then inquires whether the mechanism is the same in the case of the small electric spark. On applying Becquerel's method—viz.: observations through a trough of distilled water, which intercepts the N-rays—it is found that, contrary to what happens in the case of the sulphide screen, the changes of luminosity are seen as clearly as without a trough. This

objective effect is confirmed by the photographic records. Incandescent platinum behaves in the same way as the spark.—*Comptes Rendus,* June 6; Lond. *Elec.,* June 24.

Electric Equilibrium of the Sun.—ARRHENIUS.—A theory of the process by virtue of which the sun is enabled to give out a continuous supply of negative electricity, without its positive electrification being raised to such a high point as to retain the negative electrodes in the sun. This process necessitates some form of circulation or renewal of the negative electricity in the sun and the author makes such a circulation plausible. Negative ions condense vapors more easily than positive ions. The gases in the atmosphere of the sun are ionized by the ultra-violet radiation. Therefore, we have to suppose that of the many little drops formed by condensation in the sun's atmosphere far more are negatively charged than are positively charged. As these drops are driven way by the pressure of radiation they charge with negative electricity the atmosphere of celestial bodies, such as the earth, until the charge is so great that discharges occur, and cathode rays are formed which carry back the charge to the universe. The charge of the sun is sufficient to attract and absorb negative electrons traveling with observed velocities anywhere within 1.25 light-years of the sun. Since the nearest star is four light-years away, and there are other stars about 10 light-years off, not many electrons can traverse interstellar space without being attracted by some star or other. Thus the suns recover from the space as much negative electricity as they lose. The electric charges of the suns are very effective regulators. If the charge is quadrupled the mean distance of the caught electrodes is doubled, or in other words, as they are uniformly disseminated in space, their quantity is quadrupled. Therefore, the supply of negative electricity to the suns is proportional to their defect thereof.—*Proceedings of the Royal Soc.,* June 2; Lond. *Elec.,* June 24.

REFERENCE.

Magnetic Particle in a Magnetic Field.—ANDERSON.—A mathematical note on the direction of the force acting on a small magnetic particle in a magnetic field.—*Phil. Mag.,* July.

ELECTRO-CHEMISTRY AND BATTERIES.

Chemical Engineer.—SANDERS.—A communication referring to a recent paper of Herreshoff. The author thinks the field of chemical industries is now large enough to accommodate two specifically-trained classes of chemists in addition to requiring on occasions the service of an engineer for problems clearly within his province. The trained analyst is a necessity. But our universities should also provide a course with the object of inculcating in the student the principles of chemical economics. In the latter course a great part of the work in quantitative analysis should be eliminated, and great stress should be laid on certain economical principles, governing the proper procedure in several operations common to many processes, e. g., teaching absorption of gases by liquids, tower packing, mist condensation, etc. Next in importance is the study of the economical significance of physico-chemical phenomena. Electrochemical possibilities should not be neglected and the student should be familiarized with the control of an electric current and with electric apparatus. The transmission of power and the handling of material are of immense importance in a chemical factory. Steam engineering and the choice of materials of construction should also be taught. —*Electrochem. Ind., July.*

Electrolytic Production of Calcium.—RATHENAU.—An abstract of a German Bunsen Society paper on an electrolytic method, devised by Suther and Redlich, for producing calcium in sticks. The feature of the method is that the cathode is gradually raised during operation, in such a way that the calcium deposited at the end of the cathode always remains just in contact with the fused bath. Calcium rods are thus obtained of 3 by 4 cm. diameter and 20 to 30 cm. length. In the discussion, Muthman stated that it is quite easy to produce calcium from a mixture of two-thirds of $CaCl_2$ and one-third CaF_2.—*Electrochem. Ind.,* July.

Aluminum Film.—MOTT.—An account of an experimental investigation of the dimensions of the films on aluminum anodes. Several methods are described. The thickness of the film is roughly a linear function of the voltage applied. At 25 volts the thickness of the film formed in phosphate solution is 0.00002 cm. and at 100 volts it is 0.00008 cm. The thickness depends on the electrolyte used, sulphates giving thickest films and citric acid thinnest films at the same voltage.—*Electrochem. Ind.,* July.

REFERENCE.

Bunsen Society.—DANNEEL.—The first part of a report of the recent general meeting of the German Bunsen Society with abstracts of the papers presented. The present installment contains the abstracts of the following papers: Applications of the phase rule to alloys of iron and carbon, by Roozeboom; hardening steel by sudden cooling, by Heyn; electrolytic manufacture of calcium, by Rathnau; dissociation phenomena at high temperatures, by Loeb; colloids, by Jordis; passivity of metals, by Müller.—*Electrochemical Ind.,* July.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Reading off Deflections.—CHABOT.—An illustrated description of a compact arrangement for reading off deflections of galvanometers, etc., with the possibility of increasing the sensitiveness without increase of space or loss of light. The light from the scale 1 in Fig.

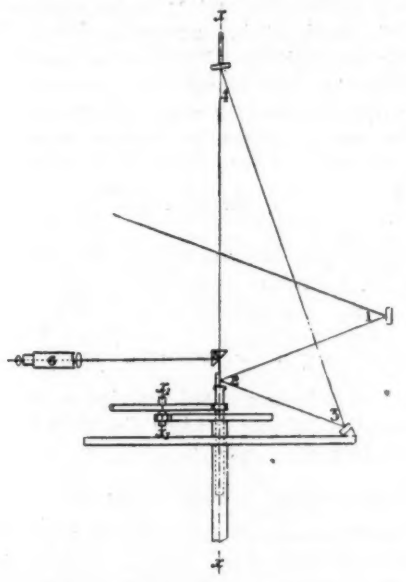


FIG. 3.—READING DEFLECTIONS.

3 is received by the mirrors 2 and 3, the instrument mirror 4, the totally-reflecting prism 5, and on passing through the telescope 6 reaches the eye of the observer. The instrument mirror moves about xx as axis, while the mirrors 2 and 3 are maintained in continuous rotation about the same axis, and in such a manner that by means of double-reduction toothed gearing, x_1x_1, the mirror 2 is given n times (where n is an integer) the angular velocity of the mirror 3 about xx. The mirrors 3 and 2 may be driven pneumatically by means of a foot bellows, the compressed air driving a small turbine wheel carried by the axle of the mirror 3; the speed need only be high enough to produce a continuous picture of the scale by means of what are in reality intermittent flashes of light; for this purpose a small regulating stop-cock is fitted to the air-supply pipe. The action is as follows: For each revolution of the mirror 3 about the axis xx, the mirrors 2, 3 and 4 come into optical conjunction only once, hence the light from the scale can momentarily reach the eye of the observer only once during each revolution of 3. Now, when the instrument mirror 4 is deflected through an angle α about the axis xx, the position of momentary conjunction between the mirrors 4 and 3 is shifted through an angle α one way or the other, depending on the direction of deflection relatively to the direction of rotation of the mirror 3; at the instant of this conjunction, however, the mirror 2, which rotates n times faster than the mirror 3, will be displaced forward or backward through an angle $n\alpha$, so that the light which is reflected at 2, 3 and 4 must come from a part of the scale whose angular distance is $2n\alpha$ one way or the other from the initial reading. The path of the ray from 2 to 3, 3 to 4 and 4 to 5, evidently lies on the same plane, and this plane follows the deflection α of the instrument mirror 4 about the axis xx. Thus a mere increase in the velocity ratio n of the mirrors 2 and 3 increases the sensitiveness of the arrangement, and does so without any increase of space or loss of light.—*Phil. Mag.,* July.

Platinum Resistance Thermometry.—WAIDNER AND DICKINSON.—An abstract of an Am. Phys. Soc. paper on apparatus for platinum resistance thermometry, as used in the National Bureau of Standards. A special form of resistance bridge is described which has

been designed for use with resistance thermometers of the "compensated lead" type, which combines high accuracy with rapidity in working. This bridge may be briefly described as a mercury contact bridge, with a series of coils embodying the essential features of standard resistance coils, ranging from 0.01 ohm to 50 ohms; the finer settings being made on three 10-step shunt dials, which take the place of a bridge wire and which read in steps of 0.001, 0.0001 and 0.00001 ohm, respectively. The adjustment of these coils in the shunt dials need only be approximate, without introducing an appreciable error. This bridge also contains all the necessary reversing battery and galvanometer keys and an Ayrton-Mather shunt, and four sets of ratio coils that can be conveniently reversed for eliminating inequalities in the ratio arms.—*Phys. Rev.*, July.

REFERENCES.

Platinum in Electric Pyrometers.—CAMPBELL.—An article giving notes on the crystalline structure of platinum, its occlusion of and permeation by gases, its behavior at high temperatures, etc., with special reference to the use of platinum in electric resistance pyrometers and thermoelectric pyrometers.—*Electrochem. Ind.*, July.

Tests of the Regulation of Motors.—WORKMAN.—A continuation of his serial on factory testing of electrical machinery. He discusses the regulation of motors and describes in the present installment the methods of testing the regulation of a motor belted to a generator, loaded on resistances, or by loading-back methods. In the latter case the motor may be loaded back on a generator of the same or greater capacity and of the same voltage, or it may be loaded back on a machine of lower voltage, but of the same current capacity.—*Elec. Club Jour.*, July.

MISCELLANEOUS.

German Association of Electrical Engineers.—An account of the proceedings at the recent annual meeting of this association held in Cassel. The number of members is now 3,421. Abstracts are given of the work of various committees. Concerning standardization of current and voltage for use on shipboard it was decided to accept as the standard the direct-current system at 110 volts. This is in agreement with British practice. Fick read a paper on the necessity of a legal regulation of electrical transmission lines. This paper is reprinted in full. There was a longer discussion as to the position which the association should take toward the proposals made by the American Institute of Electrical Engineers as to new units and notation of electrical quantities. It appeared that the general sentiment was against the acceptance of these proposals. On motion of Teichmueller the meeting voted against the proposals of the American Institute, and the Board of Directors has declined to have the association represented by official delegates in St. Louis. "Since in St. Louis, the majority deciding on the proposals of new units and notations will certainly be on the side of those who have made the proposals, it is, of course, probable that the proposals will be accepted, even if some representatives of the association should speak and vote against them. By sending delegates to St. Louis the Board of Directors would merely support a matter toward which German electrical engineers are not friendly inclined, and it is, therefore, better that the association decline to participate officially in the Congress. Moreover, it is to be remarked that such important decisions as concerning new units should not be left to the incidental make-up of the membership of a Congress though it may be international. In former Congresses the voting membership was not arbitrary or incidental in so far as all decisions on questions of units and measures were made by delegates authorized by their governments. The number of delegates sent from each country was chosen according to its importance in science and industry by an agreement of the governments of the different countries and the decisions were reached not by the members of the general Congress, who were incidentally present, but by the delegates of the governments."—*Elek. Zeit.*, July 7.

Reissued Controller Patent.

A patent issued July 19 to W. B. Potter of the General Electric Company, on the well-known series-parallel controller for two series-wound traction motors, using magnetic blow-out and interlocking switches, is of interest in showing that matters may sometimes be hastened even when patents are concerned, the application for reissue having been filed July 21, 1904, less than one month previous to the date of issue. The original patent was dated August 14, 1894.

New Books.

MODERN WIRING DIAGRAMS AND DESCRIPTIONS FOR ELECTRICAL WORKERS. By H. C. Horstmann and V. H. Tousley. Chicago: F. J. Drake & Co. 157 pages, 177 illustrations. Price, $1.50.

This is a useful handbook for electricians. The diagrams are carefully arranged and adequately explained in simple terms. No attempt is made to include a complete theory of the apparatus used, only that amount of information being given which will prove of service to the practical man. Where some explanation is necessary, that attempted is characterized by accuracy and as much thoroughness as is consistent with brevity. Diagrams of such circuits as one engaged in any branch of electrical construction work will have occasion to use, are included. The book deserves a place in the toolbox of every electrical worker.

TRAITÉ ÉLEMENTAIRE DES ENROULEMENTS DES DYNAMOS À COURANT CONTINUE. By F. Loppé. Paris: Gauthier-Villars. 78 pages, 39 illustrations.

This little volume gives in a form convenient for ready reference formulas for the winding schemes of bipolar and multipolar direct-current machines. The usual amount of space is devoted to the discussion of the theory of direct-current dynamos and their armature windings, and the significance of the formulas for expressing the throw of coils, number of slots and connections to commutator segments is adequately explained The author then develops the formulas for the winding of dynamos as carried out commercially.

The book seems to contain nothing which is new to the art, but presents in a condensed manner that which has become standard practice, omitting all "freak" schemes.

ELECTROTECHNIQUE APPLIQUÉE. By A. Manduit. Preface by A. Blondel. Paris: V. Ch. Dunod. 813 pages, 557 illustrations. Price, 25 francs.

This volume treats in great detail of the design and test of both direct and alternating-current machinery, the calculation of distributing systems and the selection of central station machinery, and discusses the various phases of electric traction. Very little which is new is to be found under direct-current machinery. Under alternating-current machinery, however, there is included much that is relatively new in textbook literature. The author discusses the properties of the alternating-current series motor and the repulsion motor, and treats of their commutation difficulties. The Schüler repulsion-induction motor is also briefly mentioned. The advantages and disadvantages of polyphase motors for traction are reviewed, and the Arnold electro-pneumatic traction system is described. Compensated induction motors (Heyland and Latour) and self-exciting shunt and compound alternating-current generators (Heyland and Boucherot) are treated at some length.

For explaining induction motor performance and assisting in testing these machines, use is made of the well-known Heyland and Blondel circle diagrams. The book describes Blondel's oscillograph and the ondograph of Hospitalier, and discusses quite fully the analysis of non-sinusoidal waves. The treatment is to a large extent non-mathematical, free use being made of graphical diagrams for representing the electrical phenomena, while the descriptive matter is amply complete and presented in an entertaining manner. The author has evidently spared no effort to bring the contents up to date, and has succeeded in producing a text thoroughly well written and one which will prove of value to students and electrical engineers.

CARE AND HANDLING OF ELECTRIC PLANTS. By N. H. Schneider. New York: Spon & Chamberlain. 100 pages, 66 illustrations. Price, $1.00.

So much has been written on this subject that at the present day the task before an author is rather to select what to discard than to create new matter. The subjects treated by the author of this manual are confined to direct-current dynamos and motors, electrical measuring instruments, the storage battery, the incandescent lamp and the oil engine. The theoretical discussion is of elementary character without mathematical proof, and in the main is sufficiently accurate for the purpose of the book. The author seems to express his own peculiar ideas on the effect of changing magnetic flux, as indicated by italicized terms in the following extract: "If an electromagnet be rapidly magnetized and demagnetized it and the coils

become hot from what are called eddy currents, or Foucault currents, which are currents induced in the iron and coils by the changes of the current strength. When in the iron they are termed *eddy* currents; when in the copper coils, *Foucault* currents. They oppose the passage of the true current by offering a false resistance to it, termed reactance. Where this opposing current occurs in a revolving armature, it is termed *counter electromotive force.*" The chapter on the storage battery is somewhat more complete than the others. Among the methods of controlling batteries, the "end cell" is given most prominence, while the booster method is not mentioned. A number of practical hints are given on the selection and care of incandescent lamps. A chapter on the management of the oil engine has been included, evidently on account of the fact that the manual is intended for those who are called upon to operate a military electric plant. The manual is of pocketbook size, bound in leather and contains a sufficient amount of practical information to render it of value to those in practical charge of army electrical plants.

Telephone Card-Display Device.

The purpose of this invention is to provide a simple, convenient and inexpensive means of bringing before the eye of the telephone user any one of a number of cards and automatically holding them in position to be read, and when desired instantly returned to their original position. It is thus adapted for use as an auxiliary telephone directory of a number of persons or business houses with whom communication is frequent. Each firm's name is written or printed at the top of a card, on which is also printed the index letter of the name in large red type. Under the name is placed the telephone number and exchange, and under that any announcement pertaining to the business of the firm that may be desired. These cards are arranged alphabetically in narrow slots radiating from the center of a cylindrical holder. The holder shown in the illustration is cut to accommodate 80 cards.

This holder and its radiating cards are then mounted on a shaft terminating in a milled nut, which projects through the sides of a cylindrical case, in which the whole is enclosed. This cylindrical case has a short section removed from its periphery and a deflector inserted, whose purpose it is to engage the top of the cards as they are rotated, and bend them back so as to make the card directly in front plainly visible. The case is provided with a suitable clamp for fastening the device to the upper part of the telephone stand, or to a wall 'phone, as desired.

When it is desired to find the telephone number of a person whose card is contained in the directory the milled nut is turned and the large red index letters rapidly and consecutively pass before the eye. When the index letter desired approaches, the nut is turned slower until the desired card springs into position, where it remains until the directory is again used. It will be seen that with such an arrangement the finding of any name on the list is practically instantaneous. The time consumed in finding any card is not more than two or three seconds.

The fact that the card is automatically held in position to read after once found will avoid the confusion and annoyance accompanying the forgetting and subsequent refinding of a number or exchange just as the operator is answering after a detention, the card always being before the eye. The cards are perfectly plain, having no special cutting to hold them in, and an ordinary business card of the proper size may be easily inserted.

The instrument presents a neat appearance, being nickel plated and clamped on the upper part of the telephone stand so as not to interfere with the handling of the same, and having about the same weight as the receiver, balances the instrument very nicely. It can also be attached to a wall telephone or mounted on a suitable base and used as a combination business directory and paper weight. Mr. S. Duncan Black, of Baltimore, Md., is the patentee of the device.

Wildman Wireless Telegraph System.

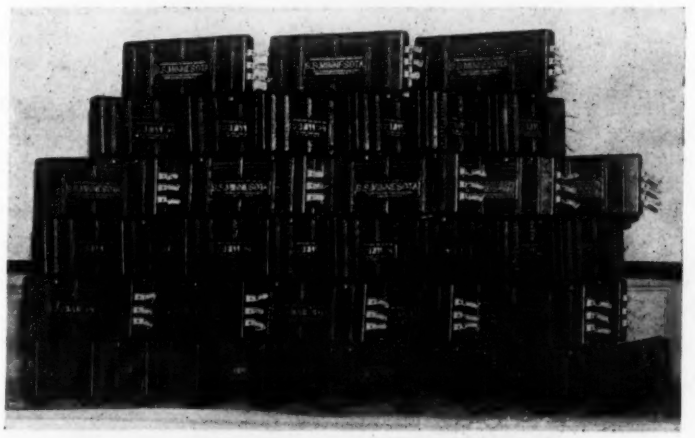
Two patents have recently been issued to Captain Leonard D. Wildman, of the United States Army, for improvements in wireless telegraphy. The first relates to a method for varying the inductance of individual aerial wires forming the radiating system, in a manner such as to alter the capacity values as little as possible. The object of this scheme is to permit the use of multiple aerials and to provide means whereby each wire is made to radiate a wave of the same definite length.

The second patent has for its object the protection of armatures of alternating-current generators used in connection with transformers at transmitting stations, since the high potentials developed have a tendency to pass surges through the armature windings and to cause it to burn out. To prevent such action the inventor connects the opposite sides of the primary circuit, which includes the inductor of the transformer, the key and the generator, with the earth through minute spark-gaps adjusted to a maximum safe potential. If for any reason the potential in the primary circuit should rise above a certain critical safe value, the increased potential will cause sparks to pass between the gaps to earth instead of passing through the armature; and thus the armature windings and insulation are protected.

FIGS. 1 AND 2.—TELEPHONE CARD DISPLAY DEVICE.

State-Room Heaters for the Steamship Minnesota.

The accompanying illustration shows a stack of electric state-room heaters made by the Prometheus Electric Company for the steamship *Minnesota,* the largest vessel ever built in this country, and the greatest cargo carrier in the world. This vessel, which is being built by the Eastern Shipbuilding Company, of New London, was launched April 16, 1903, and will probably be placed in commission next month. To gain an idea of the size of the vessel a few figures may be of interest. The *Minnesota,* as well as the *Dakota,* her sister ship, which will also be placed in commission this year, is 630 ft. long, 73 ft. 6 in. wide, 56 ft. high from the upper deck, 88 ft. high to the captain's bridge, 107 ft. high to the top of the mast, is rigged as a four-masted schooner, and has five continuous decks. In addition to these there are four decks which are not continuous and on top of all comes the captain's bridge, making nine decks in all. The gross tonnage of the vessel is 21,000, which is fully double the capacity of any other vessel ever constructed in an American shipyard. In her hull there are no less than 12,000 tons of steel plates and it took 375 tons of rivets to join these together.



STEAMER "MINNESOTA" STATE-ROOM HEATERS.

The plating of the *Minnesota's* hull is said to be twice as thick as that of the battleship *Oregon.*

The electric equipment is the most extensive and complete ever placed on shipboard. The heaters shown were especially designed for these Pacific Ocean greyhounds and embody the very latest improvements in the Prometheus system of heating. The heaters, of which there are 150 on each ship, are 15 in. in length, 7 in. high, 2½ in. deep. They are made of cast iron and mounted on four short supporting legs. Each heater is made in halves, which may be separated, permitting inspection without having to sever any connections, the contact between the halves being made by means of flat connecting springs. Each half is equipped with four ironclad Prometheus heating units, each having a capacity of 100 watts, so that the total capacity of the heater is 800 watts. This capacity is divided into two sections, so that by means of a three-heat snap switch, to which the three outlet wires are connected, three variations of heat may be obtained, the first section embracing three heat units, the second section five heat units and the third section the total of eight heat units. The units themselves are held in place by supporting racks, into and out of which they may be slipped with ease in case it should be deemed desirable or necessary. Each unit is 1¼ in. wide by 12 in. long by ⅛ in. thick, and the thermal of each element consists of a heavy copper strip, which is held in place over a pin mounted on slate by means of washers and nuts. The lower part of the back of the heater has ventilator openings and the entire front of the heater is covered with openings so as to facilitate the dissipation of the heat. The construction of the heater has been worked out with great care and for the size of the heater, which is extremely compact, is very substantial mechanically and efficient electrically. The terminal wires are brought out at the end of the heater through porcelain bushings, and great care has been taken in the design of the heaters to insure the most perfect insulation, the heater having been designed for a 230-volt circuit. It is intended to place one of these heaters in each of the staterooms, and heaters of a more ornamental design are being placed in the cabins, dining-rooms and library.

The vessel, though designed primarily as a cargo ship, can carry 172 first cabin passengers, 110 second cabin, 68 third cabin and 2,424 steerage passengers, and her crew will number 250 men. Her speed will be 14 knots.

Single-Phase Traction in Europe.

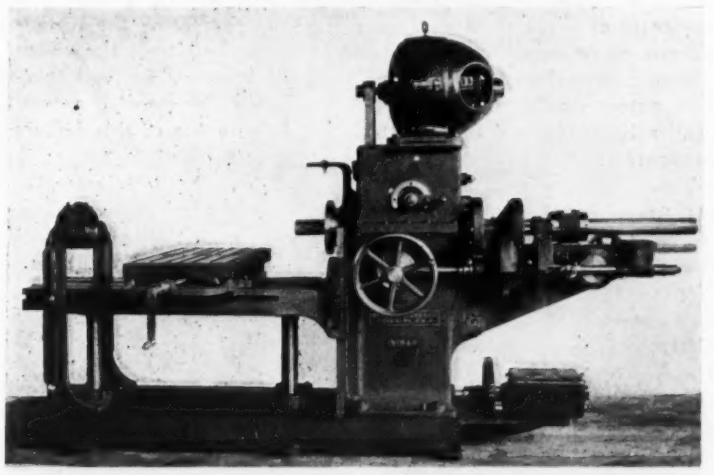
It will interest our readers to hear that the Finzi system of single-phase electric traction, with which thorough and successful tests were made last year on the street car lines of Milan, Italy, as noted in these columns, is now to be tried on a still larger scale on the well-known Valtellina electric railway, a normal gauge line operating under steam railway conditions between Como, Lecco, Colico, Sondrio and Chiavenna, in Northern Italy.

This line belongs to the Societa Italiana per le Strade Ferrate Meridionali, and has been operated for the past few years as a three-phase, alternating-current electric road. In order to compare the merits of the three-phase and the single-phase systems the railway company has decided to make extensive tests, and has ordered for the purpose one of its standard motor cars to be equipped with the Finzi system. The equipment will consist of four single-phase, alternating-current motors, each rated for a normal output of 100 hp at 200-400 volts, together with the necessary controlling apparatus. The car is to be controlled electrically from either end; but no rheostats will be used, thus making the regulation very efficient. The current will be taken from the 3,000-volt overhead contact line direct by means of the standard type of Valtellina roller trolley. Each of the four motors will drive one of the four axles of the double-truck car by means of an intermediate gear.

The specifications for this apparatus call for sufficient capacity in the motor equipment to haul trains of 100 tons from Lecco to Sondrio at a speed up to 45 miles per hour, and the comparative tests between the two systems will doubtless be watched with great interest by all connected with electric traction matters. The Finzi system is represented in this country by Muralt & Co., of 25 Pine Street, New York.

Motor-Driven Horizontal Boring and Drilling Machine.

It is rather a difficult problem to connect an electric motor directly to a horizontal boring and drilling machine and get the required number of speed changes. The accompanying illustration shows a Bement standard No. 2 horizontal boring and drilling machine with a direct-current motor. The motor is 10 hp and has a range of speeds from 392 to 1,100 r.p.m. by the multiple-voltage system. It



MOTOR-DRIVEN BORING AND DRILLING MACHINE.

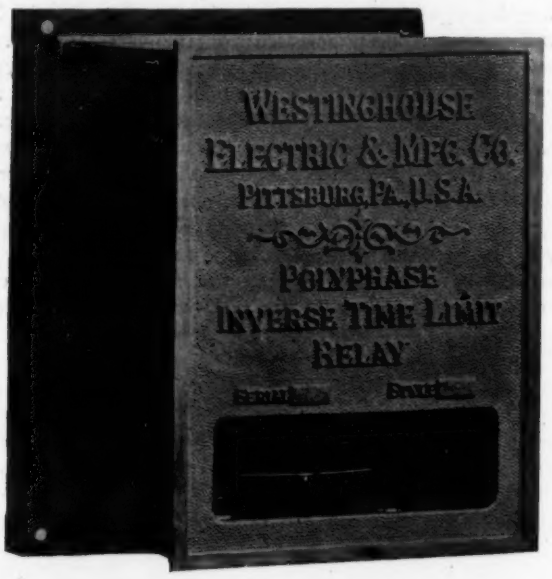
is mounted on a box which also forms an enclosure for gears, and is connected to the train of gears by a Renold silent chain.

In addition to the range of speeds in the motor, there are three changes by gearing which are controlled by the lever shown on the side of the gear case. An auxiliary motor is provided for elevating the table. This machine was built by the Bement-Niles works of the Niles-Bement-Pond Company.

New Inverse Time Limit Relay.

The inverse time limit relay is a recent addition to the line of electrical appliances designed for general use and marks a distinct advance in the protection of line apparatus from the effect of overloads. As its name suggests, the time element is in inverse proportion to the amount of current required to operate it. In other words, the greater the need for its action the quicker it responds, and this feature marks the difference between the inverse time limit relay and the time limit relays which preceded it and are more widely known.

The ordinary time limit relay, as generally employed in connection with the tripping coil of a circuit-breaker, insures the line current from interruption until an overload shall have been sustained for a



INVERSE TIME LIMIT RELAY.

predetermined period which is long enough to threaten the safety of the apparatus. A movable contact then meets a stationary contact in the relay, and the tripping circuit in the breaker is closed, causing it to rupture the line current. The action of the inverse time limit relay is similar, except that the speed with which the movable contact travels is regulated by the amount of the overload, and it thus differentiates between a short-circuit, which requires an immediate action of the circuit-breaker, and a slight overload which will cause no damage unless sustained until the thermal effect is dangerous. Both types prevent unnecessary interruption of the service from slight momentary overloads by preventing the instantaneous operation of a circuit-breaker, but in the simple time limit relay the time element is fixed, while in the inverse time limit relay it is automatically adjusted to any excess of the normal current from a light overload to a short circuit. The value of this feature is apparent.

The accompanying cut illustrates a new inverse time limit relay announced by the Westinghouse Electric & Manufacturing Company. It is made in types for both single and polyphase circuits, the single-phase relay containing one electromagnet with its regulating mechanism and the polyphase type consisting essentially of two single-phase mechanisms in a case, and properly connected. The electromagnet consists of two coils connected in series with a series transformer, and having a U-shaped laminated iron core from which the moving contact is suspended. When an overload occurs the core is drawn into the coils, raising the moving contact until connection is made with the stationary contact and the tripping circuit is closed.

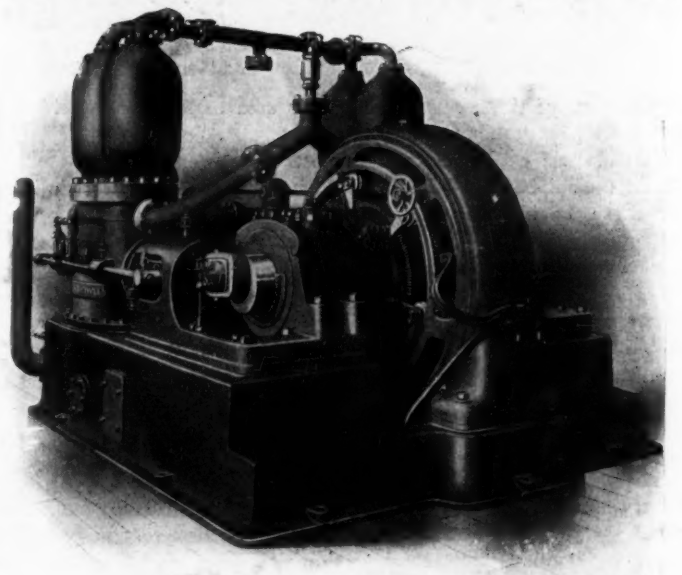
The variable time element is supplied by an air check, which is connected with the magnet core by a vertical rod. As the core and moving contact rise the air in the checking chamber is compressed and acts in the same manner as a dash-pot in retarding the closure of the circuit. An intake valve allows the checking chamber to fill quickly when the overload is removed, and the relay is thus automatically reset. The outlet valve furnishes the inverse time limit feature, as the ball which closes the valve is held lightly under the compression of a coiled spring, the amount of the pressure upon the valve from within regulating the size of the opening. When a slight overload occurs, the pressure upon the check is light and the air escapes slowly through a small opening. In the event of a short-circuit, the magnet core would be drawn rapidly upward, the air being expelled quickly from the valve which the pressure would force wide open, and the tripping circuit would be closed. The effect upon the time limit varies with the amount of overload, the length of time being in inverse proportion to the excess of current. Should the overload cease before the contacts touch, the magnet core drops to its original position and the relay is reset. The simplicity of this arrangement insures its perfect action under all conditions and permits a sturdiness of construction not always found in conjunction with so sensitive and delicate an operation.

Adjustments are provided covering a wide range in time and current. The stationary contacts can be raised or lowered, thus varying the distance traversed by the moving contacts. Both the intake and the outlet valve of the air check are adjustable, thus controlling the speed with which it is emptied and filled. The leverage of the counterpoises attached to the check is also subject to adjustment, and by means of weights placed upon the scale pan beneath the magnets the weight of the moving element is increased.

High Speed Motor-Driven Pump.

The operation of pumping machinery by electric motors offers especially in mines many obvious advantages, such as the centralization of the power plant, elasticity of extension of the system, high efficiency and small first cost and small expense for attendance.

In the pump which we illustrate herewith advantageous features have been secured by the simple expedient of connecting the pump plungers to cranks mounted directly upon the shaft of the motor. This pump has a capacity of about 250 gallons per minute against 1,000-ft. head when running at a speed of about 300 revolutions. So carefully have the internal parts of the pump been designed, however, that its mechanical efficiency is over 93 per cent., approxi-



MOTOR-DRIVEN PUMP.

mating closely that of the highest types of large steam pumping engines. The pump is of the duplex type; the cranks at the opposite ends of the motor shaft being set at right angles to each other. The plungers are of the outside-packed pattern and the two plungers of each pump are connected by side rods. The plungers are 3½ in. in diameter and have a stroke of 5½ in. The pump and motor are mounted upon a rigid box-girder frame and the unit is self-contained and occupies a relatively small space. It embodies many novel features of construction and the most careful attention has been given to the design of the internal parts, as well as to the running parts and oiling devices.

This type of pump, which has only lately been introduced, has salient advantages, including simplicity of construction, small space requirements, cheapness of installation and attendance. The pumps

are built by the Blake & Knowles Steam Pump Works, of 114 Liberty Street, New York City, in capacities of from 200 to 4,000 gallons per minute and for heads varying from 100 to 2,000 ft. One of these pumps, operated by a direct-current motor, is exhibited in the space of the General Electric Company at the St. Louis Exposition.

Ventilating Fan Equipment.

A novel and compact type of ventilating fan equipment has just been developed by the Northern Electrical Manufacturing Company, of Madison, Wis. This consists, as the engraving shows, of a Northern ring type motor mounted in a Bayley ventilating fan. The equipment is unusually compact and sturdy and possesses all the good features of Northern direct-current machinery.

The ventilating fans illustrated are built in sizes of 18-in., 24-in., 30-in., 36-in., 42-in., 48-in. and 54-in., with capacity ranging from 3,890 to 35,000 cu. ft. of free air per minute. The Northern universal motor, as used in the equipment shown, is a modification of the spherical type. Instead of being provided with feet, however, it is cast with a circumferential ring on the field. The design and method of construction are such that the armature is in accurate alignment with the circumferential ring, which is carefully machined. Thus the matter of aligning the motor shaft with any machine with

VENTILATING FAN.

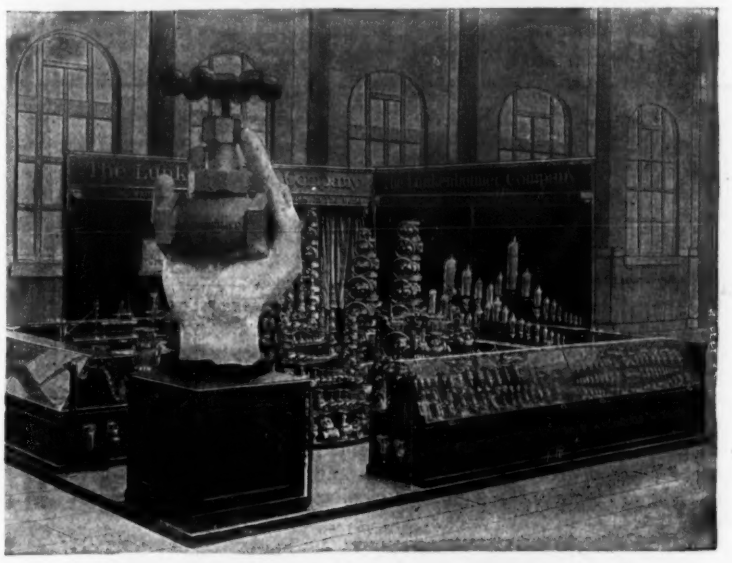
which it is connected is a small matter. For the support of the motor, a clamp ring is provided which encircles the ring on the motor. This type of motor is in extensive use in a variety of industries, and is applied to elevator hoists, exhaust fans, motor-operated valve gears, etc.

The Lunkenheimer Exhibit at St. Louis.

In the Machinery Hall Building, location 5 G, Block 26, is the unique exhibit of the Lunkenheimer Company. It is easily identified by a large model of their familiar "Valve in Hand," which occupies a prominent corner of their exhibit, as shown by cut. Pyramids of globe, angle, cross, lever and gate valves, of various designs and sizes, both brass and iron, are artistically arranged about the exhibit, and are agreeably offset by a black plush curtain at the side and rear.

The glass cases arranged in front of the exhibit contain a smaller class of the goods manufactured by them, such as lubricators, oil and grease cups, cocks, etc., of all sizes. Neat designs of racks containing various sizes of whistles, injectors, pop valves and a variety of other specialties, lend to make up an exhibit worthy of notice. New designs of water gauges and oil pumps for cylinder lubrication are features in themselves.

Dispersed about the exhibit are pipe fittings of every description, together with whistles, safety and check valves and numerous other appliances. The large variety of steam goods exhibited by the Lun-



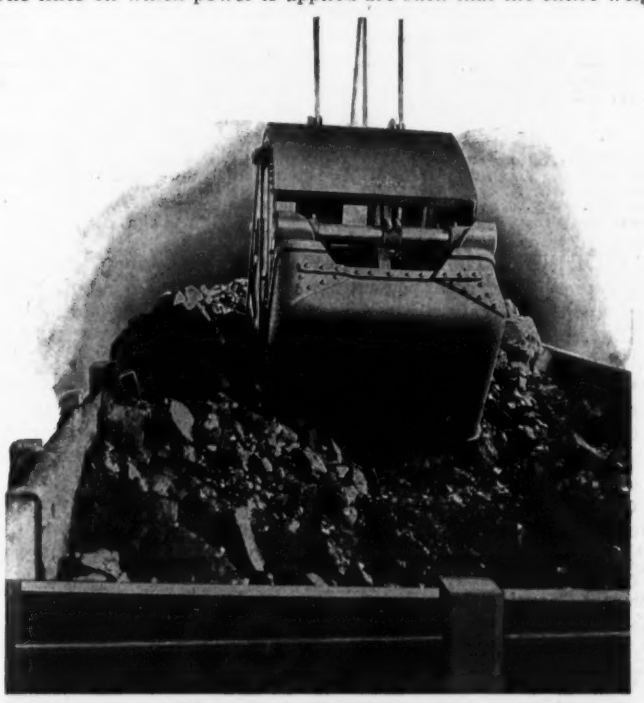
LUNKNEHEIMER EXHIBIT.

kenheimer Company and manufactured by it necessitates more than a casual glance to thoroughly appreciate the exhibit in all its details, and the space is a centre of attraction at all hours of the day.

Coal Grab Buckets.

The illustration herewith shows the "Class A" grab bucket recently brought out by the Jeffrey Manufacturing Company, of Columbus, Ohio, for handling lump and run-of-mine coal. Its path is such that it is absolutely self-filling under all conditions, and the weight of the enclosed coal assists the buckets to close.

The lines on which power is applied are such that the entire weight



COAL GRAB BUCKET.

of bucket and load is utilized at closing with sufficient force to crush the largest lumps should they come between the scoops. These buckets are made in the most substantial manner to withstand hard usage, and in sizes of from 15 to 160 cu. ft. capacity, and are used in unloading coal of any commercial size from cars, vessels or barges, for shipment or stocking, also for reloading from storage piles.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Quieter conditions prevailed in the stock market, and manipulation, either to sustain prices or to facilitate realizing, was apparent. Public interest was on a diminished scale. The United States Steel shares took a downward turn, being affected by authoritative statements minimizing recent views as to the current and prospective steel trade improvement. Amalgamated Copper was the object of bullish manipulation. There were rumors of deals in the traction group, with more or less activity based thereon, particularly in Brooklyn Rapid Transit. The sales of this stock aggregated 148,700 shares, at prices ranging between 50⅝ and 53, the closing quotation being 52½, a net gain of 2⅛ points. There was active selling in Metropolitan Street Railway between 115⅞ and 117⅝, closing at 116¼, this being a net loss of ¼ point. General Electric and Westinghouse were both weaker, the former closing at 162, a net loss of 2 points, and the latter at the same price, which represents a loss of 2½ points. Allis-Chalmers common made a net gain of 1½ points, closing at 10, which was also the highest point of the week. Western Union closed at 88⅛, and American Telephone & Telegraph at 132¾, being net gains of ⅛ and 2¾, respectively. The curb market for outside securities was rather quiet, but firm for the most part. Following are the closing quotations of July 26th:

NEW YORK

	July 19	July 26		July 19	July 26
Allis-Chalmers Co.	9	11¾	Electric Vehicle	9¼	9
Allis-Chalmers Co. pfd.	44⅜	52	Electric Vehicle pfd.	13⅜	13⅛
American Tel. & Cable.	88	89	General Electric.	163¾	160½
American Tel. & Tel.	133	131⅛	Hudson River Tel.	..	..
American Dist. Tel	24	22	Metropolitan St. Ry.	117⅛	115
Brooklyn Rapid Transit.	52⅝	50¾	N. Y. & N. J Tel.	147	147
Commercial Cable.	178	181	Marconi Tel.	..	..
Electric Boat.	40	41	Western Union Tel.	88	88
Electric Boat pfd.	70	70	Westinghouse com.	162½	154
Electric Lead Reduction.	⅜	⅛	Westinghouse pfd	180	175

BOSTON

	July 19	July 26		July 19	July 26
American Tel. & Tel.	132⅝	131½	Western Tel. & Tel. pfd.	92	*90
Cumberland Telephone.	113¼	114	Mexican Telephone.	1¼	1¼
Edison Elec. Illum.	248	248	New England Telephone.	124½	124
General Electric	..	160	Mass. Elec. Ry.	*20	17½
Western Tel. & Tel.	12½	12½	Mass. Elec Ry. pfd.	*74	70

PHILADELPHIA.

	July 19	July 26		July 19	July 26
American Railways.	47⅛	47	Phila. Traction.	98⅝	98¾
Elec. Storage Battery.	60	60	Phila. Electric.	6⅛	6⅜
Elec. Storage Battery pfd.	60	60	Phila. Rapid Trans.	13⅜	13
Elec. Co. of America.	9⅛	8⅛			

CHICAGO

	July 19	July 26		July 19	July 26
Central Union Tel.	..	..	National Carbon pfd.	103	103
Chicago Edison.	142	143	Metropolitan Elev. com.	19⅛	19⅛
Chicago City Ry.	175	170	Union Traction.	4¼	4¼
Chicago Tel. Co.	120	120	Union Traction pfd.	27	26
National Carbon.	29¾	30			

*Asked

DIVIDENDS.—The second quarterly dividend of 1½ per cent. at the rate of 6 per cent. per annum has been declared upon the preferred stock of Michigan State Telephone Company, payable August 1. The Automatic Electric Company's directors have declared the regular quarterly dividend of 2 per cent., payable August 1. The Western Telephone & Telegraph Company has declared a semi-annual dividend of 2½ per cent. on preferred. This is an increase of 1½ per cent. A director of the company says: "The earnings of the company for the past six months have been very satisfactory and the directors felt justified in increasing the semi-annual rate of ½ per cent. to 2½ per cent." As the preferred stock is 6 per cent. cumulative, the declaration of only 2½ per cent. allows ½ per cent. for the six months to accumulate. Directors of the Boston Elevated Railroad Company have declared a regular semi-annual dividend of 3 per cent., payable August 15th.

INTERSTATE COMMERCE REPORT FOR 1903.—The Interstate Commerce Commission reports earnings for the railways of the United States for year ending June 30:

	1903	1902.	Increase.
Gross	$1,900,846,907	$1,726,380,267	$174,466,640
Expenses	1,257,538,852	1,116,248,747	141,290,105
Net	$643,308,055	$610,131,520	$33,176,535
Other income	205,687,480	196,323,629	9,363,851
Total	$849,095,535	$806,455,149	$42,540,386
Charges	552,619,490	526,178,822	26,440,668
Surplus	$296,376,045	$280,276,327	$16,099,718

Gross earnings increased 9.2 per cent. while net earnings increased 5.4 per cent. and surplus increased 5.7 per cent.

PHILADELPHIA ELECTRIC.—A special dispatch from Philadelphia says: "There is still talk on the street of a deal pending between Philadelphia Electric and Keystone Telephone, and from Keystone Telephone sources it is stated that the plan for a new electric company in Philadelphia to compete with Philadelphia Electric will never be dropped until some arrangement shall have been made for the leasing or selling of the Keystone conduit space to the Philadelphia Electric Company, if not for the taking over of the Keystone Company bodily by Philadelphia Electric. A Philadelphia Electric director says that neither of these steps is likely so far as the Philadelphia Electric Company is concerned and that no proposition directly or indirectly from the Keystone Telephone Company has reached the Philadelphia Electric board."

SAO PAULO STOCK AND BONDS.—The Sao Paulo Light & Power Company directors have decided to issue $1,000,000 of new stock at par for the purpose of retiring a similar amount of the bonds. The bonds will be bought in the open market. Their present selling price is 89½. The present capital of the company is $7,000,000 of stock and $6,000,000 of bonds. The operation will result in a reduction of $50,000 annually in the fixed charges, but the dividend charges will be increased to the extent of $80,000,000, the net result being an increase of $30,000 in the annual disbursements by the company. It is stated that it is the policy of the management to gradually wipe out the bonds and leave the stockholders sole proprietors of the property. The company recently increased its dividend from 6 to 8 per cent.

TROLLEYS IN ILLINOIS.—The Springfield, Lincoln, Bloomington, Pekin & Peoria Electric Railway Company held a stockholders' meeting in Springfield, recently, at which the capital stock of the company was increased from $50,000 to $300,000. Surveys have been completed between Springfield and Lincoln and contracts will be let in the next few weeks for grading. Financial arrangements for the division of that system are well under way. The company now expects to build 30 miles of the road and put it in operation by Jan. 1, 1905, if possible. Mr. O. A. Farrar is chief engineer. The system is known as the "Corn Belt Line."

WESTINGHOUSE LONG-TERM NOTES.—It was announced last week that Kuhn, Loeb & Co. had purchased $4,000,000 Westinghouse Electric & Manufacturing Company three-year 5 per cent. notes endorsed by the Security Investment Company, of Pittsburg. The notes are to cover recent investments in the British Westinghouse Company and to provide further funds for the purchase of the Lackawanna & Wyoming Valley Railroad, a third-rail electric road running from Scranton to Wilkesbarre, Pa., which was built primarily to demonstrate the practicability of the third-rail system for heavy traffic.

NEW WESTINGHOUSE STOCK.—The Westinghouse Electric & Manufacturing Company will issue a circular to stockholders prior to August 1st with reference to issuing additional stock, the amount of which is understood to be 50,000 shares. The Westinghouse Electric Works at East Pittsburg are now employing about 7,000 men. The company's output runs from $2,000,000 to $2,500,000 a month, and new orders are coming in in encouraging volume. There appears to be every indication of increasing business from now on.

GENERAL ELECTRIC EARNINGS.—The General Electric Company shows from January 31 to May 31 a total gross income of $12,201,001, with total costs, expenses, etc., of $9,766,571, or a surplus of $1,557,096 after paying dividends of $877,334. This amount added to the previous surplus gives a total surplus of $8,850,785. General business has been but very little below that of 1903, and the outlook is decidedly improving.

LONG ISLAND LIGHTING MERGER.—A certificate of merger of the Newtown & Flushing Gas Company with the New York and Queens Gas Company has been filed at Albany, N. Y., with the Secretary of State. The New York & Queens Electric Light & Power Company in 1900 absorbed the Flushing Gas & Electric Light Company and the Newtown Light & Power Company, which together have controlled the lighting system of Queens County.

NIAGARA POWER MORTGAGE.—The Niagara, Lockport & Ontario Power Company has voted to mortgage its corporate property for $24,000,000 to secure bonds for a like amount. It will file with the Secretary of State at Albany a modified certificate of incorporation to permit it to transmit electric power as far east as Utica and south to the Pennsylvania line. The New York directors include Cassius M. Wickser and Stephen S. Palmer.

RICHMOND (VA.) RECEIVERSHIP.—Messrs. Wickham and Northrop, receivers for the Virginia Passenger & Power Company, at Richmond, have made their report No. 1 to Joseph Waddill, of the United States District Court, and are now preparing report No. 2 relating further to the affairs of their charge. The report informs the court that the property has been insured with Davenport & Co. for $1,000,000. They have appointed Andrew Welsh cashier and L. B. Siegfried assistant and placed them under bond. The report shows that the receivers found $2,033.50 in cash when they took charge, and $5,109.40 in the Planters' Bank, which was credited on a demand note held by the bank against the company.

COMBINING PORTLAND, ORE., TROLLEYS.—It is said that negotiations will be concluded within the next few days for the merger of the City & Suburban Company and the Portland Railway Company, the two big competing street railway companies of that city, which, together, operate an aggregate of 112 miles of track. The property of the City & Suburban Company is valued at $2,500,000, and of the Portland Company at $1,500,000. The reason assigned is to obviate an expense of about $1,000,000 a year now being expended in extensions of the systems to meet competition.

FINANCING WESTCHESTER DEAL.—The United Gas Improvement Company, in payment for its holdings of the Westchester Lighting Company, which has been sold to the Consolidated Gas Company, will accept 4 per cent. mortgage bonds of the recently incorporated New York & Westchester Lighting Company, guaranteed by the Consolidated Gas Company. It is understood that these bonds will be taken at par.

HOOSAC VALLEY TROLLEY BONDS.—The Massachusetts railroad commissioners have authorized the Hoosac Valley Railway Company to issue $400,000 5 per cent. 20-year bonds and $105,000 additional stock for funding floating indebtedness and refunding purposes. The new stock will be issued to stockholders at $105 a share.

B. R. T. BONDS.—The Brooklyn Rapid Transit Company has made application to the stock exchange to list $5,000,000 more 4 per cent. bonds, which have been recently sold. This will make $10,000,000 of these bonds listed. The authorized issue is $150,000,000.

WEST END RAILWAY BONDS.—The Railroad Commissioners have authorized the West End Street Railway Company to issue $750,000 4 per cent., 30-year bonds, to be dated August 1, 1902, and 3,000 shares of common stock. The common stock will be sold at public auction.

LARGE TELEPHONE MORTGAGE.—A mortgage for $1,000,000, executed by the Commercial Telephone Company to guarantee bonds to the same amount, was filed last week for record in the clerk's office of Saratoga County, New York State.

SEATTLE LIGHTING BONDS.—N. W. Harris & Co. are offering to investors $950,000 Seattle Lighting Company, first mortgage bonds, due 1944, but optional at 110 and interest on and after March 1, 1910.

Commercial Intelligence.

THE WEEK IN TRADE.—The general mercantile and industrial situation, while not active is hopeful, and there are no disturbances discernible anywhere on the horizon save the butchers' strike and other labor irregularities. A good fall trade is looked for in view of the continued improvement in the crop situation. Among the industries quietness prevails. The production of iron and steel is being slightly curtailed with a resulting firmer tone in pig iron prices. Finished products remain quiet, though there is more inquiry for rails at the West. The copper market was quiet and steady at unchanged prices, the last quotations being 12⅝ @ 12⅞ c. for Lake; 12½ @ 12¾ c. for electrolytic, and 12⅜ @ 12½ for casting stock. Several basic industries still show little tendency to revive. Soft coal mining is depressed and the demand for anthracite is not so active as heretofore. The cotton goods industry is threatened with a strike of print-cloth hands at Fall River, and thus the unsettled condition of that market, which has prevailed for a year or more, is likely to continue. The warm weather helped retail trade as a whole. From all sections good reports are made as to local business. *Bradstreet's* reports that the business failures for the week ending July 21st aggregated 190, against 203 the week previous and 183 the corresponding week last year.

NEW YORK SUBWAY DAMAGES.—Profiting by past experiences in litigations over property damage while constructing the rapid transit tunnel in New York City, the contractors for the subway under the bay from Whitehall Street to Brooklyn and into that borough have evolved a plan for their own protection. Some time ago these contractors got together and quietly provided for a board of expert examiners to follow all their work and make records of the property damages and general conditions, to which recourse could be had at any future time in the event of suits being brought by property owners. The board, which is known as the "Commission of Examiners of Property Adjoining the Brooklyn and Manhattan Railroad," is located at 51 Chambers Street and consists of Perez M. Stewart, builder; Raymond F. Almirall, architect, and John G. Van Horne, engineer. Mr. Stewart, who was superintendent of buildings for Manhattan under Mayor Low, is the chairman of the board and Mr. Almirall is the secretary. The board has been following in detail every foot of the work done by the contractors in lower Broadway and on the Brooklyn end. They have examined walls and buildings adjoining the work and have made minute records to which they can refer at any future time in case of claims by owners that certain damages were inflicted at certain times. Absolute secrecy has followed this work, and thus the existence of the board did not become known for months after it was organized.

BIG ALLIS-CHALMERS ORDER.—With regard to a big turbine order already noted briefly in these columns, the New York *Times* says: "The Allis-Chalmers Company, which has been making preparations for months past to enter the electrical field on a large scale, is said to have just obtained a contract for installing nearly 100,000 hp turbo-generating equipment, asserted to be the largest contract of the kind ever made in the world, the value being upward of $2,000,000. The contract is reported to have been awarded by Thomas E. Murray, acting as consulting engineer for the Brooklyn Rapid Transit Company, the New York Edison Company and other companies in which Anthony N. Brady is the dominant factor. There will be six 5,500-kw turbines, direct-connected to 25-cycle, 750-r.p.m., three-phase alternating generators. The latter machines will be wound to give either 6,600 or 11,000 volts. One is to be installed in a huge power house which the Brooklyn Rapid Transit is to erect at Kent and Division Avenues, and which will contain almost 100,000 hp. Twelve turbines in all are to be put in the plant. The second largest contract of the kind was for three 5,500-kw outfits which the Westinghouse Company will furnish for the proposed Long Island City power house of the Pennsylvania Railroad." There is a good deal of mystery around this report.

PNEUMATIC TUBES FOR ENGLAND.—An organization to be known as the British and Foreign Syndicate has been formed in London for the purpose of developing the pneumatic tube business. Mr. J. E. Milholland, of Lewis, N. Y., states that he has spent four years in consummating the plans for the organization. The first construction work contemplated is the laying of 95 miles of double lines of tubes in London, involving an expenditure of nearly $15,000,000. The mileage will gradually be extended until the metropolis is covered with about 300 miles of double lines of tubes. Twelve-inch tubes will be used, as it has been demonstrated that these are sufficiently large to carry between 80 and 90 per cent. of everything sold in stores. It is the intention of the syndicate to undertake the entire delivery of goods for large establishments, and the British Post Office is to be treated on the same footing as are other customers. Mr. Milholland added that the work of construction would be under the charge of Sir John Wolfe-Barry, with Prof. William C. Unwin as consulting engineer.

MORE MANHATTAN CARS.—The Manhattan Elevated road has ordered 100 new "trailer" cars, at a cost of $350,000. In a short time a car will be added to each train on the Third Avenue line, which runs during the "rush" hours, making seven-car trains instead of six, as at present. Half the elevated trains are made up of "trailer" cars. Of the 100 new "trailers" ordered, 50 will be made by the St. Louis Car Company and 50 by the Nassau Manufacturing Company, although the trucks for the cars built by the latter company will be manufactured by the St. Louis concern. These trucks were especially designed by Mr. Frank Hedley, general superintendend of the Interborough Company.

RECEIVER FOR CONOVER COMPANY.—An order signed by Vice-Chancellor Garrison has been filed at Trenton, N. J., appointing Frank H. Stillman, of New York, and Frank B. McDermott, of Jersey City, receivers for the Conover Manufacturing Company, which is alleged to be insolvent. The complainants are Thomas Cogan, secretary; E. K. Conover, president, and the Greenville Coal & Ice Company. It is alleged that the company has liabilities aggregating $76,727 and nominal assets of $99,992. Of the latter nearly $25,000 is in unfinished stock and contracts. The company, it is said, has no funds with which to carry on its ordinary business and owes protested notes amounting to more than $4,000. It is engaged in the manufacture of steam condensers in Jersey City.

ROCHE BATTERIES FOR JAPANESE WARSHIPS.—Mr. William Roche, of 42 Vesey Street, New York, has recently made a large shipment of navy standard dry batteries for use on Japanese warships. Last year he exported nearly 3,000 cells to the Mikado's government.

SOME C. & C. ORDERS.—The C. & C. Electric Company, of 143 Liberty Street, New York, has secured a contract from the Nairn Linoleum Company, of Kearney, N. J., for a 120-hp motor and a 150-kw belted generator. The machines will be of three-bearing type and used for power purposes. The horseshoe Forestry Company has ordered another 120-hp C. & C. motor to serve as additional operating equipment for its Adirondacks sawmills. The Chattanooga (Tenn.) Medicine Company's plant is to have a Hoe press driven by a series parallel equipment of 20-hp capacity. Shea, Smith & Co., Chicago printers, have requisitioned for a 40-kw belted generator for light and power. The Hamilton Apartment Realty Company, which is putting up an apartment hotel in Philadelphia, has ordered two 75-kw and one 50-kw generators for lighting use. The generators will be direct-connected to 110-hp and 75-hp Harrisburg standard engines. The new Tabor Building at Pearl and Wall Streets, which is being built by the George A. Fuller Co., is to be installed with one 75-kw and one 50-kw C. & C. generator, direct connected to Skinner engines. The Twenty-eighth Street company of which C. F. Rogers is president, has ordered, through Percival Robert Moses 275 hp of equipment for its twelve-story building going up at 10-14 East Twenty-eighth Street. There will be two 65-kw C. & C. generators direct connected to 100 hp Harrisburg standard engines, and one 50-kw direct coupled to a 75-hp engine of same manufacture. Among foreign orders recently secured is one for four 25-hp motors for lighting purposes in Australia.

LIGHTING PLANT FOR THE PHILIPPINES.—Mr. August Mietz will ship to the Philippine Islands the first isolated plant ordered by the Provincial Boards of the islands. This plant is to be installed by Henry D. Woolfe, electrical contractor at the new building erected by the Board of Bulacan, Province of Malolos. The plant consists of a 200-light C. & C. generator, driven by a 20-hp Mietz & Weiss kerosene engine, switchboard for four circuits, twelve arc lamps and sixteen fans. Mr. Woolfe has already installed several isolated plants for various private persons and one 500-light installation for the United States quarantine station near Manila. A demand for isolated plants driven by Mietz & Weiss engines is now on foot, as these kerosene engines have proved both reliable and economical, especially in localities distant from Manila, where coal is expensive.

EQUIPMENT FOR NEW CUSTOM HOUSE.—Considerable equipment will very shortly be purchased for installation in the new Custom House under construction at Bowling Green, New York. The general contractor for the building is John Peirce, of 277 Broadway. Burt S. Harris, of 79 Wall Street, is the electrical engineer. The specifications are now in the hands of the supervising architect, J. Knox Taylor, Washington, D. C., and bids will be invited next week for wiring 7,000 lamps, switchboards, fire alarm, burglar and clock systems, and over a score of motors varying in capacity from 3 hp to 75 hp each—about 600 hp in all. The boiler capacity will be about 2,000 hp. Current will be taken from the street for the first year anyway.

MEXICAN ELECTRIC RAILWAY.—Mexican advices state that Antonio Zaldivar, of Merida, Yucatan, has sold the concession recently granted him for the construction and operation of an interurban electric railway to be built between Hunucuna and San Antonio, touching the intermediate towns of Somajii, Kinchil and Zetis, to a syndicate composed of Yucatan capitalists. The principal people concerned in the new deal are Eusebio Escalante Bates, Carlos Peon Machado and Nicholas Escalante Peon. The latter gentleman, who is managing director of the United Railroads of Yucatan, is now on a visit to the States. He is at the Hotel Seville, Twenty-ninth Street and Madison Avenue, and is at the offices of Thebaud Brothers, 87 Broad Street.

ELECTRIC PUMPS FOR DRESSED MEAT PLANT.—The New York Butchers' Dressed Meat Company, Eleventh Avenue and West Thirty-ninth Street, is to have a very extensive electrical equipment and has contracted with the Stilwell-Bierce & Smith-Vaile Co., of Dayton, Ohio, through their manager, George W. Neff, 93 Liberty Street, for a number of triplex electric pumps and direct-connected electrically driven centrifugals. The equipment is intended for the operation of the rendering plant, etc. There will be 16 pumps in all. The necessary motors, varying in capacity from 2 hp to 10 hp, will be of General Electric build. Horgan & Slattery, 1 Madison Avenue, are the architects for the plant.

THE STANLEY CO.—The resignation of Dr. F. A. C. Perrine from the first vice-president and general management of the Stanley Electric Manufacturing Company, reference to which was made in our last issue, will cause some important change to be made in the direction of separating the constructing and selling departments, which during his regime came under his direct personal supervision. Mr. C. C. Chesney, who succeeds Mr. Perrine as first vice-president, will confine his attention to the constructing end of the business, while Mr. M. D. Barr, second vice-president, will have charge of the sales division. Mr. Barr was in New York for a couple of days this week.

MORE TURBINES FOR LONG ISLAND CITY.—The Long Island City power plant of the P. R. R., for which three 5,500-kw turbo-generating sets were ordered several months ago from the Westinghouse interests, is to be equipped with three other machines of similar size. The boilers now ordered consist of 32 units of 520 hp each, i. e., 17,640 hp in all. Another equipment of the same capacity will be ordered. Babcock & Wilcox Co. secured the first contract. Contracts will also be made shortly for condensers, steam pumps, etc. Westinghouse, Church, Kerr & Co. are the general contractors.

THE SAFETY INSULATED WIRE & CABLE COMPANY, of 114 Liberty Street, has secured a large contract from the New York Police Department for the extension of the underground cable system in connection with the telephone service in the boroughs of Manhattan, Brooklyn and the Bronx. A substantial contract has also been secured for additional cable for the fire alarm system of the Fire Department in the boroughs of Manhattan and Brooklyn. The last shipment of cable to be used in the Seattle-Sitka system left for the Pacific Coast this week. There were 11 carloads of cable.

NEW NIAGARA POWER ENTERPRISE.—According to a Buffalo dispatch dated July 18, the Niagara County Irrigation & Water Supply Company, a new power canal enterprise involving an expenditure of $10,000,000, has filed a map of the proposed canal. The route of the canal is from La Salle, where the water will be taken from the Niagara River, to the Devil's Hole, below the falls. A power house will be located at the Devil's Hole. It is stated that the plant will have a capacity of 150,000 hp.

DODGE & DAY, modernizing engineers, Philadelphia, in conjunction with Ballinger & Perrot, architects, are proceeding with the work of rebuilding and extending the plant of the Victor Talking Machine Company, Camden, N. J. The shops are to be electrically operated and motor drives used throughout. The work is to be completed within six months from date. This is the same concern that suffered a severe damage by fire a short time since.

LARGE NEW YORK CENTRAL POWER HOUSE.—Mr. C. Wellesley Smith, architect, has filed with the Department of Buildings, in the Bronx, plans for the construction of an immense power house for the New York Central & Hudson River Railroad Company, on One Hundred and Forty-ninth Street, 95 ft. west of Long Island Sound. The plans provide for a three-story brick structure, 236 ft. long by 166.4 ft. in width, to cost $450,000.

NORTON & COLE MANUFACTURING COMPANY, Perin Building, Cincinnati, Ohio, are in the market for a first-class, second-hand, alternating-current dynamo, size 200 kw., 125 cycles, 1,000 volts, for which they will pay spot cash. They have on hand a large stock of automatic and Corliss high-grade engines, both simple and compound, as well as B. & W. water tube and horizontal tubular boilers.

ELECTRIC PUMPS FOR PRODUCE EXCHANGE BANK.—Orders have been awarded through Mr. Ernest Flagg, architect, for some of the equipment which is to go into the Produce Exchange Bank building, Broadway and Beaver Street, New York. The International Steam Pump Company secured an order for a number of Deane pumps to be direct connected to General Electric motors.

TO SUPPLY POWER FOR EL ORO MINES.—The El Oro Mining & Railroad Company, a British capitalized concern, which operates extensive property in the El Oro mining region, Mexico, is, according to advices just to hand, preparing to develop water power to generate electricity for mining purposes. Mr. R. M. Raymond is the general manager of the company.

ANOTHER MEXICAN WATER POWER SCHEME.—Mexican advices state that Gonzalo A. Velasco and Octavo L. Velasco, of Mexico City, are primarily interested in a project to construct a hydraulic plant on the Santa Ana River, Tlalnepantla district, State of Mexico, for light and power. It is proposed to utilize about 3,000 liters of water per second.

THE REEVES ENGINE COMPANY, Trenton, N. J., notes among its recent sales an engine to the Diamond Rubber Company, of Akron, Ohio, for connection to a 150-kw generator. Also a vertical cross compound to the Brier Hill Iron & Coal Company, for direct connection to a 250-kw generator.

SHEET STEEL FOR WESTINGHOUSE.—Official announcement is made that the Westinghouse Electric Company has purchased 6,000 tons of sheet steel. It has a large amount of heavy work on hand.

General News.

THE TELEPHONE.

TUCSON, ARIZ.—The Consolidated Telephone, Telegraph & Electric Company has filed articles of incorporation with a capital of $2,500,000. Headquarters will be at Tucson. The company also proposes to furnish electric light and power. Epes Randolph is president; E. S. Ives, secretary.

SAN FRANCISCO, CAL.—The Western Union Telegraph Company and the Southern Pacific Railroad Company have united in stringing an aerial telegraph cable costing $30,000 for a distance of 35 miles along the railroad company's famous Lucin cut-off, extending across Great Salt Lake. Labor and materials will increase the total cost of the telegraph line to more than $60,000. The cable carries nineteen wires. This action shows that the telegraph company is convinced that the cut-off, parts of which have sunk beneath the surface of the lake a number of times, will be a complete success. Many predictions were made that this section of the road would have to be abandoned after several millions of dollars had been expended.

SAN FRANCISCO, CAL.—The recent incorporation of the Direct Line Telephone Co., with San Francisco as its principal place of business, has made a stir in telephone circles around the Bay. This action was taken shortly after the announcement was made that the persons interested in the Home Telephone Company, of Los Angeles, were in the market for $1,000,000 worth of telephone line supplies and that it was more than probable that San Francisco was the objective point. According to the articles just filed the Direct Line Telephone Company's proposed lines will start from the corner of Kearny and Bush Streets, San Francisco, and will eventuallly make connections with all of the towns on the Pacific Coast. The company's capital stock is fixed at $1,000,000; actually subscribed, $118,000. The directors are A. K. Andriano, of San Francisco, who subscribed for $22,500 of the stock; C. F. Runyon, Julius Fay, Robert Capelle, G. W. Emmons, J. A. Stulz and W. B. Pringle. Other subscribers include C. H. Selby, of Los Angeles; Albert Kayser, of Oakland; E. G. Koenig, Sydney Weinshenk, K. Wertheimer and Julius Finck, of San Francisco. Of late years all attempts to invade the San Francisco field, covered so thoroughly by the Pacific States Telephone & Telegraph Company, with its central exchange and sub-stations, have proved failures. However, the Automatic Direct Line Telephone Company, in which some prominent financial people own stock, has made some headway in installing interior telephone systems in local business blocks. The similarity of the names of this concern and the new company is significant, and developments are awaited.

COVINGTON, GA.—The Covington telephone exchange was completely destroyed in a recent fire.

PEORIA, ILL.—Plans are being prepared for a new building to be erected here by the Interstate Telephone Company.

SHELBYVILLE, ILL.—The Windsor & Okaw Mutual Telephone Company has been incorporated with a capital stock of $900. The directors are J. W. Herron, J. H. Haste and others.

ALTON, ILL.—The Farmers' Mutual Telephone Company will apply for a franchise in Upper Alton. The officers are J. S. Culp, president; J. T. King, vice-president; Joel Williams, secretary; W. H. Cartwright, treasurer.

ALTON, ILL.—The stockholders of the Fosterburg-Wood River Telephone Company have elected the following-named directors: Edmund Beall, D. M. Kittenger, J. P. King, W. H. Cartwright, J. S. Culp, Samuel Harris, Albert Penning, Harry Thompson and Joel Williams.

DARLINGTON, IND.—The Darlington Telephone Company has increased its capital from $1000 to $10,000.

TALMA, IND.—The Talma Company has been incorporated with a capital stock of $5000. The directors are S. J. and L. Grove and others.

BROWNSVILLE, IND.—The Brownsville Co-operative Telephone Company has increased its capital stock $5000 for the purpose of making extensions and improvements. W. H. Hawkins is president and Chas. Bell, secretary.

SLOAN, IA.—The People's Telephone Company has been incorporated with a capital stock of $15,000.

OTTUMWA, IA.—The Iowa Telephone Company will make improvements to its system to cost $80,000. It will include a new central building and conduit work.

FAIRFAX, MINN.—The Fairfax Telephone Company has been incorporated with a capital stock of $10,000.

SHAKOPEE, MINN.—The Merchants & Farmers' Telephone Company has been incorporated with a capital stock of $10,000. H. P. Marx is the president.

SILVER CITY, N. M.—The Grant County Telephone Company will extend its telephone line from the G. O. S. Cattle Company's ranch to Gila Hot Springs, 65 miles north of Silver City.

COHOES, N. Y.—The Commercial Union Telephone Company has increased its capital stock from $10,000 to $800,000.

WILMINGTON, N. C.—The Southern Bell Telephone Company is erecting a long-distance line from Wilmington to Marion, S. C., to connect with a line to Florence, S. C. The distance is 80 miles.

COLUMBUS, OHIO.—The Carroll Telephone Company has been incorporated with a capital stock of $5000 by O. B. Brandt, J. P. Gundy, H. A. Brown, John W. Ash and T. P. Sylvester.

COLUMBUS, OHIO.—The Salem Township Rural Telephone Company has been incorporated with a capital stock of $2000, by H. A. Halverstadt, E. P. Aldridge, Homer Halverstadt, E. H. Simon, H. V. Zimmerman and J. W. Brinker.

PRINCEVILLE, ORE.—The Central Oregon Telephone Company is being formed here. The capital stock will be $3000. Messrs. A. L. Goodwillie and W. E. Guerin are among the incorporators.

BROOKVILLE, PA.—The Red Bank Telephone Company has been incorporated with a capital stock of $10,000.

FINLEYVILLE, PA.—The Bethel Telephone Company has been incorporated with a capital stock of $5000. The directors are W. T. Phillips, James P. Wilson and others.

PHILADELPHIA, PA.—The Standard Telephone & Telegraph Company, which owns valuable franchises in Bucks County, Pa., and in New Jersey, has been placed in the hands of receivers. It is a Pennsylvania corporation capitalized at $100,000. Both the Bell and Keystone Telephone Companies have been endeavoring for some time to acquire control of the corporation. I. D. Ginhart, auditor of the Keystone Telephone Company, was appointed one of the receivers. This is accepted as evidence that the Keystone Company has gained control. The other receiver is T. O. Atkinson, treasurer of the Bucks County Trust Company. Application for receivers was made by John A. Roebling Sons' Company, wire manufacturers, of Trenton, N. J., who presented a claim of $6000 for goods sold. Other claims amount to $18,000. The receivers are empowered to continue the business.

CONWAY, S. C.—Hon. R. B. Scarborough is interested in a new telephone system at Conway. The charter has been received, but stock will not be offered for sale until the exchange is in working order.

MITCHELL, S. D.—The Independent Telephone Company of Yankton, S. D., will build a long-distance line here from Yankton.

DEADWOOD, S. D.—The Home Telephone Company of Deadwood, S. D., is rapidly getting its lines up in first-class shape, many of them now being completed. General Manager Clyde Dunseth is very much pleased with the number of subscribers added since he took charge, and particularly with the number of old patrons who have returned, showing plainly that they were only waiting until they saw that the company meant business. A large list of new subscribers has recently been added. The line to Spearfish is completed and many subscribers have been added there. The Sturges line is working in first-class shape, and as soon as the Belle Fourche line is completed, the Sturges subscribers will be able to get connection.

FORT ATKINSON, WIS.—The Jefferson County Telephone Company of Fort Atkinson, Wis., has made a number of improvements and changes in its system which have resulted in a largely increased list of subscribers. The International Telephone Manufacturing Company of Chicago furnished not only the central office equipment throughout, but the additional telephones required. The new switchboard is of the well-known International self-restoring drop type and is provided with a number of special features, among which might be mentioned pilot-lamp supervision over both the lamp and clearing-out drops, special flash light transfers, etc. The board is arranged for an ultimate capacity of 600 lines with four hundred line equipments installed.

ELECTRIC LIGHT AND POWER.

JASPER, ALA.—The Jasper Water, Light & Power Company has been incorporated with a capital of $50,000, by J. M. Cranford, L. W. Lollar, D. K. Carter and others.

JACKSON, ALA.—Mr. Geo. F. Brockman, of this city, is building a large hydraulic electric light plant here. The plant will be operated on the direct-current system. Mr. Brockman expects to have the plant in operation about Oct. 5.

GLOBE, ARIZ.—It is announced by Charles M. Clark, of the Globe Power Company, that the big project of establishing an electric power plant for Globe and the adjacent mining camps is soon to be carried out as originally planned. The United States Government granted the company the necessary right of way for its canal, transmission lines, etc., a few weeks ago. It is estimated that the cost of constructing and installing the plant will be about $1,200,000. There will be one tunnel 7657 feet long and about eight miles of small tunnels, ditches and flumes. The minimum horse-power to be generated is 6000.

SAN FRANCISCO, CAL.—Still another electric power plant is projected in Shasta County, Cal., to transmit current to Redding and other points. J. E. Frick, of Berkeley, who has filed on 40,000 inches of water, to be taken from Rising River and Crystal Lake at a point six miles east of Redding, says that the capitalists who are behind him will form a company and install a power plant which will transmit electricity down the Sacramento Valley. The above mentioned sources of water are also tributary to Hat Creek, from which the Shasta Power Company expects to divert water for its projected plant. It is said that an extensive transmission system will be constructed.

PENSACOLA, FLA.—The Pensacola Suburban Electric Company has been organized here by A. C. Berry, J. E. Wolfe and others.

GENESEO, ILL.—A new electric light plant is proposed for this city.

CHICAGO, ILL.—The Illinois Heat & Light Company has been incorporated with a capital stock of $15,000. The directors are E. T. Noble, C. E. Moore and others.

SAYBROOK, ILL.—The Saybrook Electric Light, Heat & Power Company has been incorporated with a capital stock of $10,000. The directors are E. E. Sayler and others.

MUNCIE, IND.—The Electric Company of America, which recently purchased the Muncie Electric Light & Steam Heating Company's plants in this city, is preparing to expend $150,000 in bettering the light service and extending steam heating mains.

BOONE, IA.—The City Council has decided to award the electric lighting contract in this city to the Boone Electric Light & Street Railway Company for a period of five years at the rate of $62.50 per lamp per annum. Eighty 1200-cp arcs are used and the Philadelphia schedule is in force here.

CLARION, IA.—The municipal light plant at this place is being remodeled.

WILTON JUNCTION, IA.—G. W. Bissell, of Ames, Ia., has prepared plans for improvements to the village electric light plant.

BOONE, IA.—The Council has awarded a contract for city lighting for five years to the Boone Electric Light & Street Railway Company for 80 lights of 1200 candle-power at $62.50 per light per year.

NESS CITY, KAN.—A new lighting plant has just been installed in this place by C. H. Brassfield and A. S. Foulks. C. H. Brassfield is superintendent and general manager.

PEMBROKE, KY.—The Pembroke Light & Water Company has been incorporated with a capital stock of $20,000. The directors are T. E. Jameson, J. T. Garnett and others.

TRAVERSE CITY, MICH.—A municipal lighting plant is being considered here.

MANISTIQUE, MICH.—The Electric Light & Power Company here will enlarge its power plant.

ST. IGNACE, MICH.—The city authorities are in the market for a complete incandescent lighting plant.

ROYALTON, MINN.—The village council will vote on the proposition of issuing $10,000 bonds for a lighting plant.

SEDALIA, MO.—The city authorities are considering the advisability of erecting a plant for the purpose of lighting the streets of Sedalia.

OAKLAND, NEB.—A special election will be held here Aug. 8 to vote on $8000 light bonds.

NEWARK, N. J.—The public service corporation of New Jersey will probably extend its main system from Plainfield to Fanwood and Westfield.

CARLSBAD, N. M.—The Public Utilties Company has been organized here with a capital stock of $100,000, for the purpose of acquiring, installing, owning and operating telephones, telegraph lines, etc., and to acquire, construct and maintain a dam for the production of water-power which shall be used to generate electrical energy for electric light systems. The incorporators of the company are William A. Finley, Matthew S. Groves, William J. Barber, J. O. Cameron and Dr. Fred F. Doepp.

NEW YORK, N. Y.—The Knickerbocker Light & Heat Company of New York has been incorporated, capital $550,000. Directors: F. P. Billmeyer, H. R. Brayton and H. S. Fairchild of New York.

ALBION, N. Y.—The Albion Power Company has elected the following-named officers: President, Gen. Bird W. Spencer; vice-president and general manager, W. C. Johnson; treasurer, J. H. Tyng; secretary, Sanford T. Church,

GENEVA, N. Y.—Plans are under way for the consolidation of the electric light plants of Auburn, Waterloo, Seneca Falls and this city. The electric power and lighting plants in this city, Waterloo and Seneca Falls are already under the management of one company, the Geneva Power & Light Company, and it is said the plans also contemplate the acquiring of the Auburn plant.

NIAGARA FALLS, N. Y.—The control of the Niagara Falls Gas & Electric Light Company has passed into the hands of Canadian capitalists. The company has been re-organized and the following officers elected: President, F. A. Dudley, Niagara Falls, N. Y.; vice-president and treasurer, Frederic Nicholls, Toronto; temporary secretary, Harry Highland, Niagara Falls, N. Y.

LEXINGTON, N. C.—As soon as plans and specifications are completed bids will be asked for the electric light plant. John H. Moyer is mayor.

ATHENS, OHIO.—The Athens Gas Light & Electric Company has been sold and succeeded by the Athens Municipal Electric Light Company.

COLUMBUS, OHIO.—An ordinance to provide for issuing bonds for erecting and completing the electric light works in this city has been passed by the council.

ENTERPRISE, ORE.—The electric lighting plant owned by William Makin at Enterprise, was destroyed by fire July 14, the loss on machinery being estimated at $5000.

NEW CASTLE, PA.—The council will expend $8,000 more on the extension of the municipal conduit system.

SPRINGFIELD, PA.—The Springfield Electric Light Company has been chartered. The capital stock is $5000.

McKEESPORT, PA.—The Finance Committee of the Council has favorably recommended an ordinance providing for an issue of $125,000 bonds for a municipal electric light plant.

FRANKLIN, PA.—O. C. Harris, D. W. Klinefetter and others are about to apply for a charter for the Franklin Electric Company, which proposes supplying electric light, heat and power in Franklin Borough.

BELTON, S. C.—The Belton Power Company has been organized here with a capital of $100,000 and will develop about 5000 horse-power from the flow of the Saluda River. This energy will be transmitted electrically for the operation of cotton mills. This town will also be electrically lighted. John B. Adger, of Charleston, is president and treasurer of the company.

SARDIS, TENN.—The Sardis Electric Company has been incorporated with a capital stock of $25,000. The directors are L. L. Pearson, R. P. Corey and others.

HARRISONBURG, VA.—The town council has decided to issue $60,000 30-year bonds for the purpose of installing an electric light plant.

STUART, VA.—The Stuart Light & Power Company has been incorporated with a capital stock of $5000. The directors are E. J. Harvey, J. Axford and others.

WAUSAU, WIS.—The Council is considering the construction of an electric light plant at an estimated cost of $33,000.

JANESVILLE, WIS.—The Council has passed an ordinance requiring that electric light and telephone wires be placed underground.

THE ELECTRIC RAILWAY.

SACRAMENTO, CAL.—The Sacramento Gas & Railway Company contemplates enlarging its switchboard and extending its distributing lines.

SANTA ROSA, CAL.—The Marin Shore Railroad, recently incorporated, intends to build a railway about 15 miles long, to be operated by electric power. The projected road will start at a point in or near San Rafael, thence to and around San Pedro Point in Marin County, and thence to a point at or near Ignacio. The principal place of business of the enterprise is to be Petaluma. John A. McNear and G. P. McNear are among the directors of the company.

WINDSOR, COL.—The Windsor Town Board has granted an electric railway franchise to the Northern Colorado Electric Railway Company. The company proposes to build its main power plant at Windsor, operating lines from here to Fort Collins, Greeley, Loveland, Cheyenne and Denver.

CHICAGO, ILL.—The City Council has granted to the Metropolitan West Side Elevated Railroad Company the right to construct a line in Fifth Avenue, from its own line in Van Buren Street to the new terminal, located on Fifth Avenue, between Jackson and Van Buren Streets. With these lines connected the company will have an independent loop, capable of handling and turning around the trains coming into its new terminal, including those of the Aurora, Elgin & Chicago Electric Railway.

BRAZIL, IND.—The Brazil Electric Company may possibly build the projected interurban railway.

INDIANAPOLIS, IND.—The latest definite interurban scheme on foot is to connect Indianapolis and Madison by an extension of the Indianapolis & Cincinnati Traction Company's Shelbyville line to Greensburg and the construction of a line north from Madison to that point.

EMINENCE, KY.—The Eminence & New Castle Electric Railroad Company, of Henry County, has been incorporated, with a capital stock of $150,000. G. W. Young, Newton Bright and L. H. Leber, of Eminence, and W. L. Nuttall, of New Castle, are the incorporators.

LANSING, MICH.—The Bessemer & Ironwood Interurban Railway Company has been incorporated with a capital of $25,000.

BATTLE CREEK, MICH.—The promoters of the Battle Creek & Coldwater Electric Railway claim to have the right of way secured for the greater portion of the distance and expect to start a gang of surveyors at work at once.

DETROIT, MICH.—At the power station and general repair shops of the Detroit, Ypsilanti, Ann Arbor & Jackson Railway, at Ypsilanti, a brass foundry has been started in connection with other work. The company now does all its own brass casting, cutting its expense four of five prices.

ST. LOUIS, MO.—Rufus W. Bailey has been appointed receiver for the St. Louis, St. Charles & Western Railroad. The line runs from the city limits to St. Charles. It is intimated that the road may be absorbed by the St. Louis Transit Company. The managers state that it has been operated at a loss, but that its business is growing larger.

PHILLIPSBURG, N. J.—The Easton Consolidated Electric Company, of Easton, Pa., is securing a right of way for the extension of the lines of the company here to Washington, in this State, and other points. The proposed extension would give a through line from Washington to Bethlehem, Pa.

ROCHESTER, N. Y.—William Nottingham, of this city, has appeared before the State Railroad Commission at Rochester and made application for a new franchise for the Rochester, Syracuse & Eastern Electric Railway Company.

YOUNGSTOWN, OHIO.—The Geneva Electric Railway Company, which plans to build from Geneva to the lake shore, has organized as follows: A. G. Webb, of Cleveland; Homer Hood, of Toledo; H. B. Gregory, of Geneva; Marcus Westerman and L. H. Young, of Youngstown. The company has been incorporated with a capital of $10,000.

PORTLAND, ORE.—Articles of incorporation of the Portland, Salem & West Side Railway will be filed soon. The new road will have 71 miles of double track, and will be operated by electricity. The incorporators named are Robert Ballentine, Charles Atherton and Frank Brewster, all of Portland. The capital stock of the new corporation is fixed at $500,000. This line will be 46 miles long. One of the two branch lines will leave the main line somewhere near Portland and proceed to Hillsboro, a distance of 15 miles from the point where it leaves the main line. The other, 10 miles long, will connect Salem with Independence.

QUEBEC, QUE.—The electric railway at Levis, Que., has ceased to operate as the result of a dispute with the Chaudiere Electric Power Company over a note for $2700. The directors of the railway intend to install an electric power plant of their own.

CLARKSVILLE, TENN.—There is a movement on foot to construct an electric railway from Clarksville through New Providence, and a committee has been appointed to report upon the advisability of granting the right of way.

GALVESTON, TEX.—Sanderson & Porter, of New York, are the new interests in the Galveston City Railway Company, the sale of which took place recently. The company has reorganized and elected new officers as follows: B. Adoue, president; J. H. Langbehn, vice-president; A. Drouilhet, of Galveston, secretary and assistant treasurer; George R. Turnbull, of New York, treasurer and assistant secretary; H. S. Cooper, general manager.

NORFOLK, VA.—The Norfolk & Southern Railway will be electrified by the Chesapeake Transit Company, thereby developing an important suburb of this city. Several cars have already been purchased.

TAZEWELL, VA.—A movement is on foot to organize a stock company for the purpose of building an electric railway from Tazewell to Burkes Garden, a distance of 12 miles.

EVERETT, WASH.—An electric railway franchise has been granted to Robert Houston by the County Commissioners.

NEW INDUSTRIAL COMPANIES.

THE OLMSTEAD ELECTRIC COMPANY, of Rochester, N. Y., has been incorporated; capital $30,000. Directors: M. J. Olmstead, J. O. Olmstead and Mary E. Olmstead, of Rochester.

THE FORD ELECTRIC & MANUFACTURING COMPANY, St. Louis, Mo., has been incorporated with a capital stock of $15,000. The incorporators are E. T. Ford, W. F. Ryan and others.

THE KEYSTONE ELECTRICAL ENGINEERING COMPANY, of New York City, has been incorporated with a capital stock of $5000. The directors are William Hewins, C. F. Thompson and others.

THE MILLERS' ENGINEERING COMPANY, of St. Louis, Mo., has applied for articles of incorporation. It will manufacture electrical and mechanical apparatus. The capital stock is $2100, one-half paid. E. E. Werner, F. R. Hattersley and J. B. Chopin are the incorporators.

THE NATIONAL ELECTROLYTIC REDUCTION COMPANY has been organized at Portland, Me., to conduct a general mining business; capital, $200,000. The promoters are Wentworth V. Lander, president and treasurer; Horace A. Bennett, West Newton, Mass.; George T. Keyes, Charles W. Keyes, Pepperell, Mass.; Henry Carmichael, Malden, Mass.; Oscar H. Hersey, Fred A. Bennett, Della R. Newell and Katie C. Hessian, Portland.

LEGAL.

A MYTHICAL LITIGANT.—Justice Fitzgerald, in the New York Supreme Court, reserved his decision on the application of the Marconi Wireless Telegraph Company of America to compel Franklin Bien to disclose the identity and present whereabouts of one Henry Gardner, plaintiff in a suit against the Marconi Wireless Telegraph Company of America for the appointment of a receiver and an accounting. Counsel for the Marconi Company said that they could not find any trace of Gardner, that he was not a stockholder of record of the company, that his charges against the company are without foundation and that his suit is without any merit. Mr. Bien declined to disclose the identity of Gardner and said that the court did not have jurisdiction to compel him to do so.

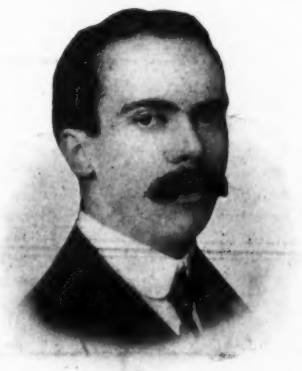
STATE SUES CHICAGO LOOP.—The Union Elevated Loop, traversing the business district of Chicago and affording terminal facilities for all the elevated railroads in the city, was made the subject of a legal attack last week. The State of Illinois asks for an injunction restraining the company from operating the loop, and for a decree requiring the company to remove immediately all the structures. It is said that property owners are back of the bil. The charge is made that money was used to buy signatures to the petition for the loop ordinance, and it is also charged that not one-half of the signatures to petitions were legally procured. Besides the Union Loop Company, the Northwestern, Lake Street, South Side, Metropolitan and Union Consolidated Companies are defendants.

STOPPED HIS METER.—For defrauding the Queens Borough Gas & Electric Light Company by inserting a piece of wood in an electric meter and so preventing it from registering, Dr. Samuel Guy, who lives in a handsome house in Clinton Place, Far Rockaway, was fined $250 last week in the Special Sessions Court at Jamaica, L. I. Dr. Guy, who was formerly a coroner in the Borough of Queens, was surprised by the severity of the sentence, but paid the fine to avoid the alternative of going to jail for a hundred days. Clarence A. Cutler, an inspector for the Electric Light Company, was the complainant. He testified that he went to Dr. Guy's residence to take an accounting of the meter and discovered that a small piece of wood had been inserted in the mechanism. It then dawned upon Cutler why Dr. Guy's lighting bills were so low. Dr. Guy frankly confessed that he had placed the piece of wood in the meter, but merely as an experiment. He said that his son had taken an electrical engineering course, and argued that it was impossible to reduce the amount of electricity passing through the meter. He placed the obstruction in the meter at night and later forgot to remove it.

MEASURING INSTRUMENT LITIGATION.—The United States Circuit Court for the Southern District of New York on July 18 handed down an opinion, written by Justice Wheeler, in a case of the Weston Electrical Instrument Company vs. the Whitney Electrical Instrument Company. The suit was brought on a patent issued to Edward Weston, dated November 6, 1888, (No. 392,387), and the decision was that the patent is infringed by an instrument made by the defendant. The court states that the parts of the defendant's instrument look quite different from the corresponding parts of the patent in suit, but notwithstanding these differences in form they are there in the instrument and do the same things in substantially the same way. The great thing to be done appears to have been to get the movable coil in its diamagnetic frame into a permanent magnetic field, compactly, and to carry the current to be measured from side to side through the coil, and move the coil against steady resistance to measure the current and record the measurement. The defendant's instruments have the permanent magnetic field provided by a magnet and a core of different and perhaps better shapes in some respects, but permitting movement of the frame in an arc of a circle to carry a pointer moving over a scale to indicate the measurement of the current. If these changes of forms are even patentable improvements, the defendants have taken and used the invention of the patent in making and using their improvements. It was held that the differences do not, any or all of them, amount to doing the same thing in different ways, but leave operative parts doing the same things in the same way. A motion for a preliminary injunction was granted. The opinion is endorsed by Judge Lacombe as follows: "Upon re-examination of the record I concur in the opinion above expressed by Judge Wheeler."

TELEGRAPH RIGHT OF WAY ON RAILROAD.—The Supreme Court of Georgia in sustaining recently the decision in favor of the Postal Telegraph Cable Company against the Atlantic Coast Line Railroad, for right of way on the Savannah, Florida & Western, has handed down an important decision, of which the subjoined is its own syllabus: 1. The telegraph company instituted proceedings against the railroad company in the county where the main office of the latter was located. The award was filed in the office of the clerk of the Superior Court of the county where the proceedings were had, and an appeal taken to the Superior Court of this county. This appeal was authorized by the law providing for condemnation of a railroad's right of way for telegraph purposes. Civ. Code 1895, §§ 4677, 4678; Acts 1898, p. 5. 2. On the appeal from the award of the assessors in the condemnation proceeding, the issue of fact for the jury is the amount of compensation to be paid for the property taken or damaged for public purposes. 3. A telegraph company acquires only an easement to the right of way of a railroad company condemned for the purpose of constructing and operating a telegraph line thereon. 4. The easement acquired embraces the land actually occupied by the poles and fixtures for guy wires, and the right to stretch the wires upon the poles, and to enter upon the right of way to construct and repair the telegraph line. 5. The only exclusive right of occupancy the telegraph company acquires by condemnation proceedings is the occupancy of the land occupied by the poles for telegraph purposes. 6. The measure of damages in such cases is the value of the land actually taken, and the extent to which the use of the right of way by the railroad company is diminished by its use by the telegraph company. 7. The right of way of a railroad company has no general market value for other uses than that to which it is applied. The appropriation to public use amounts to a withdrawal of the right of way from any use except that which is necessary or auxiliary to the operation of the railroad. 8. Peculiar advantages and benefits accruing to a telegraph company from its use of the railroad's right of way cannot be considered in the assessment of damages. The railroad company can only claim compensation for its land taken, and damages resulting from the construction and maintenance of the telegraph line. A burden not imposed by the telegraph company is not an element of damages. Thus, there was no error in excluding evidence as to the cost of the change of grade, or the clearing of the right of way and keeping it free from obstructions. 9. Remote or speculative damages cannot be recovered. The bare suggestion that at some vague time in the future the railroad company may lay additional tracks or build structures for railroad purposes is too remote to authorize the admission of evidence of the damage which might result from such possible contingencies. In its notice of condemnation, the telegraph company stipulated that, should such contingencies happen, it would remove, at its own expense, the poles and wires, so as not to interfere with such extensions and improvements. 10. The possibility of poles placed at a greater distance than their height from the track falling upon the track is too remote to be considered in estimating damages. 11. Annoyances and inconveniences to the railroad company must be real, and of such a character as to interfere in some manner with the railroad's right to exercise its business, to become an element of damage. 12. The benefit a railroad company may derive from a contract with another telegraph company already occupying its right of way is not an element of damage. The measure of damage includes, not what another telegraph company may contract for certain privileges, but the extent such contract would be impaired by the construction of the second line of telegraph. The court held that the amount found by the jury was adequate.

OBITUARY.



ERNEST KEMPTON ADAMS, PH. B., E. E., A. M.

MR. E. K. ADAMS.—It is with deep regret that we record the untimely death from nephritis, on July 21, at Watkins, N. Y., of Mr. Ernest Kempton Adams, son of Edward D. and Frances A. Adams. For some time past this gifted young engineer had been in delicate health, but it was not supposed that conditions were serious. He was only thirty years of age. While quite young, he manifested a deep interest in electricity, and his father's development of the great power enterprise at Niagara brought him in touch with many of the electrical leaders of this country and Europe. Both at Yale and Columbia, and as an editor of the *Sheffield Scientific Monthly* of the former University, electricity was his chosen theme and study, and after graduation he gave himself up to investigations and inventi ns of remarkable range and originality. As a draughtsman and mechanician he had few equals among his contemporaries, and his skill and precision in this direction could only be appreciated by those to whom, overcoming a diffidence that always stood in his way, he was willing to make disclosure. While at Columbia, under Prof. Crocker, where he assisted Dr. Pupin in some of his work, he made a series of superb dynamo drawings which to-day hang on the walls of the electrical engineering department as the best extant examples of such work done by any student there. These, moreover, embodied his own designs of dynamos and motors. Our own columns have had the benefit of several of his admirable contributions, among the most striking of which were those dealing with electrical and other methods for repeating and verifying the famous Foucault pendulum experiments as to the earth's rotation. Aside from such experimental work, he was the author of many devices of practical value, especially such as depend upon exact and accurate movements. One of the latest was a system for station annunciation on electric railways, developed with great persistence in spite of dogging sickness. Mr. Adams was a member of the American Institute of Electrical Engineers, and his fine tastes were exemplified by his membership in the Grolier Club, the Metropolitan Museum of Art (life), the Museum of Natural History of New York (life), and the New York Botanical Gardens.

He belonged also to the New England Society, the Metropolitan Club, the Riding Club, the City Club, and the Columbia and Yale Alumni Associations, as well as the Sigma Xi (scientific honor fraternity) Yale chapter. He was in addition an associate member of the Sons of the Revolution in the State of New York. Mr. Adams was married in 1902 at the Emperor William Memorial Church in Berlin to Miss Margarethe Seefeld, whose father was military commander of the Grand Duchy of Baden. He leaves a widow and a child one year old. The interment took place on Saturday last at the family mausoleum, Kensico Cemetery, New York. We are glad to understand that permanent literary record of Mr. Adams' work will soon be given to the world in the shape of two quarto volumes upon which he had himself been engaged, illustrative and descriptive of over 200 inventions and improvements made by him in physical, electrical, musical, mathematical and other classes of apparatus to which his fertile and acute mind was directed, dating even from his student days in Yale in 1896.

MR. G. F. BLAKE.—Mr. George Fordyce Blake, inventor of the Blake steam pump, died at his summer home at Phillips Beach, Mass., on July 22. He was 85 years old. Mr. Blake learned the carpenter's trade when a youth, but soon turned to mechanics and invented a water meter in 1852. In 1861 he invented a clay pulverizer, and it was to clear the clay pits of water that led him to plan the steam pump, for which a patent was issued in 1864. Mr. Blake took out numerous patents for improvements to his pump, and in 1874 the George F. Blake Manufacturing Company was formed. In 1890 Mr. Blake sold the business to a syndicate of capitalists, and when they merged it in the International Pump Company, nine years later, he retired. Mr. Blake was twice married and is survived by four children.

PERSONAL.

MR. CHARLES E. WARNER.

MR. CHARLES E. WARNER, who has accepted the position of general manager of the San Juan Light & Transit Company, San Juan, Porto Rico, is a Western man, having spent most of his boyhood in Portland, Ore. He entered Cornell University, and left there in 1890 to take up practical work. He spent several years in the various branches of railway and lighting construction in New Westminster, Vancouver, Nanimo, B. C., and Portland, Ore. He was manager of the Northwestern agency of the Westinghouse Electric & Mfg. Company, at Tacoma, Wash., from 1893 to 1898, where he had charge of the sales of that company in Washington, Oregon, Idaho, Montana and British Columbia. During the same period he had charge of the surveys and early development of the White River Power project, now one of the largest hydro-electric systems in the Northwest. In 1898 he resigned his position with the Westinghouse Company, and spent several years in engineering work in Alaska, Nova Scotia and New England, being connected in Nova Scotia with the Dominion Iron & Steel Company, and in New England with some of the high speed electric railway construction of the Massachusetts Electric Companies. His most notable electrical work, probably, has been done in the position of general superintendent of the Allegheny County Light Company, of Pittsburg, Pa. This company embraces a combination of nearly all the electric lighting interests of Allegheny County, including Pittsburg, Allegheny, McKeesport and the surrounding boroughs, with a total population of about 700,000 people. Mr. Warner infused new life into this organization and put into practice a number of important features of operating economy, beside adopting new methods of getting business. The remarkable results he has shown have attracted the attention not only of Pittsburg business men and capitalists, but have given him a broader reputation as a successful manager of electrical properties, resulting in his services being sought for the more important work of managing the combined light and railway property at San Juan.

MR. C. A. ECK, of the Eck Dynamo & Motor Works, Belleville, N. J., has sailed on a three-months' trip to Sweden.

MR. A. C. ANDERSON, who has been representing the Stanley Instrument Company abroad, has returned to this country.

MR. WILLIAM ALBERT HALL, former vice-president of the Lawrence-Hall Electric Company, of Cincinnati, Ohio, has resigned his position with the company and disposed of his interest in it.

MR. CHARLES M. SCHWAB, former president of the U. S. Steel Corporation, has decided to give $1,000,000 to Loretto, Pa., the home of his boyhood. A free electric light plant will be erected.

MR. JAMES D. HOUSEMAN, general manager of the St. Louis, St. Charles & Western Railroad, has been elected to a similar position with the St. Louis County Telephone Company with headquarters at Clayton, Mo.

MR. RUDOLFO VON BRAUN has been commissioned by the Minister of Industry and Public Works of Chili to proceed to the United States for the purpose of making a somewhat exhaustive study of the industrial applications of electricity.

MR. E. W. FARNHAM, president of the Farnham Company, of Chicago, whose third rail has been described in these pages, has been visiting New York in the hope of enlisting active interest in and the adoption of his scheme and invention. The rail is of the sectional type.

MR. F. P. FISH, president of the American Telephone & Telegraph Company, is sailing this week for Europe. It is reported that he may be home early in September. Mr. Fish is well satisfied with the Bell telephone outlook in America, and now goes abroad for rest and observation.

MR. J. W. McCROSKY, at one time one of the experts attached to Mr. Theodore N. Vail's South American electric traction interests, who afterward joined the engineering staff of J. G. White & Company, Limited, of London, is now in New York, en route for South America, where he goes on a special mission on behalf of the White interests.

DR. FREDERIC A. C. PERRINE, who has resigned from the vice-presidency and general management of the Stanley Electric Mfg. Company, has been elected president of the Construction Company of America, which controls franchises for various light, power and railway systems in Wisconsin. The former president of the company was Mr. M. D. Barr.

SENOR DON PARRAGA, of Mexico City, who represents the interests of the Safety Insulated Wire & Cable Co., of 114 Liberty Street, in the Southern Republic, has left for home after a two-months' trip here. His visit to the States was primarily made for the purpose of going into the details in a big lot of submarine cable work which is expected to be awarded shortly.

MESSRS. J. G. WHITE & COMPANY, LIMITED, of London, correspondents of Messrs. J. G. White & Company, Inc., 43-49 Exchange Place, New York, have opened offices in Buenos Ayres, Argentine Republic, to facilitate the securing of some of the important electrical contracts pending in that part of the world. So far the cream of the business has been in the hands of European, particularly German, manufacturers. Mr. Baggs, of the London office, will have charge in Buenos Ayres.

MR. A. T. HOLBROOK has been appointed district sales manager of the Boston office of the Nernst Lamp Company, located at 501 Atlantic Ave., and will have supervision of the entire New England territory. Prior to his appointment, Mr. Holbrook was connected with the district offices at Pittsburg, and had been instrumental in developing considerable Nernst lamp business in Pittsburg and surrounding cities. He is one of the oldest employes of the company, starting in with it at the commencement of its commercial life.

MR. R. M. JONES, of Denver, Col., is no longer connected with the Pike's Peak Power Company, of Victor, Col., with which he had been connected for five years past in the capacity of chief engineer and general superintendent. The construction of their hydroelectric plant is completed and the company has been consolidated with the Pueblo Traction & Highway Company. Mr. Jones has his residence at 1455 Josephine Street, Denver, and is now at liberty to take up new hydraulic and electrical work. Mr. Jones was one of the pioneer Edison engineers in the far west.

MR. H. P. USHER, for many years general business manager for the Gould Mfg. Company, Seneca Falls, N. Y., has recently severed his connection with that company to engage in business for himself. Mr. Usher will locate in Los Angeles, where he has acquired an interest in the business of the S. J. Smith Machinery Company. A dinner was tendered Mr. Usher on Saturday evening, July 16, by the Gould Mfg. Company, and was attended by the heads of the various departments. One of the pleasant features of the gathering was the presentation to him of a very handsome gold watch and chain, suitably marked, as an evidence of the esteem in which he is held by his associates, who part with him with regret. Mr. Usher is very well-known in the pump world as an exceptionally active and capable business man. He has a host of friends, who wish him the best of success in his new field.

DR. ALEXANDER C. HUMPHREYS, president of Stevens Institute of Technology, Hoboken, is confined to his summer home, at Bernardsville, N. J., with a compound fracture of his left arm. Dr. Humphreys was injured while riding a horse which he thought of purchasing. The accident occurred on Friday afternoon, July 22, on the estate of Colonel E. A. Stevens, Castle Point, Hoboken. A horse dealer sent a big black horse to Dr. Humphrey's office in the institute for him to try. Dr. Humphreys mounted the animal and rode to the Stevens estate. While passing beneath a tree, he was compelled to lean to one side suddenly to avoid striking his head against a low, hanging limb. The unexpected movement frightened the animal and it started on a gallop, throwing Dr. Humphreys from the saddle. His right foot caught in the stirrup, and he was dragged several yards before an attendant, who was riding with him, managed to stop the animal. Dr. Humphreys realized at once that his left arm had been broken, and he had the attendant assist him to his office, a block away, where he telephoned for Dr. William T. Kudlich. His fractured arm was set. Dr. Humphreys fully expects to be in condition to resume his duties at the institute when it opens in September.

NEW INSTITUTE MEMBERS.—At the meeting of the council of the American Institute of Electrical Engineers on July 19, the following associate members were elected: Adams, Francis Joseph, hospital, Westboro, Mass.; Anderegg, Gustavus Adolphus, laboratory assistant, Western Electric Company, New York City; Anderson, William Fell, superintendent Spier Falls Power Station, Glens Falls, N. Y.; Barnhart, William O., chief engineer of station, North Shore Electric Co., Evanston, Ill.; Bates, George Moulton, electrical engineer, Waltham, Mass.; Bourne, Charles Oscar, electrician, U. S. Navy Yard, Boston; Brundige, John Alvin, assistant, Niagara Construction Co., Ltd., Niagara Falls, N. Y.; Burch, Orrin, draftsman, Union Carbide Co., Saulte Ste. Marie, Mich.; Cariapa, Codanda M., student, General Electric Co., res. Schenectady, N. Y.; Condit, Benson Clare, superintendent, American River Electric Co., Stockton, Cal.; Condit, Clyde Ernest, superintendent, Tonopoh Light & Power Co., Tonopoh, Nev.; Ells, Frederick William, chief engineer, Browning Mfg. Co., Milwaukee, Wis.; Ewing, Thomas, Jr., Ewing, Whitman & Co., 67 Wall St., New York; Faccioli, Guiseppe, Crocker-Wheeler Co., Ampere, N. J.; Fahnestock, J. Harvey, inspector, Chesapeake & Potomac Telephone Co., Washington, D. C.; French, Edward Vinton, inspector, Associated Factory, Mutual Fire Insurance Cos., 31 Milk St., Boston, Mass.; Gavit, William Edmonds, treasurer, Tucker Electrical Construction Co., New York City; Geib, Adam, sub-station foreman, New York City Railway Co.; Goode, Henry W., president, Portland General Electric Co., Portland, Oregon.; Grier, Arthur Gordon, engineer, Western Electric Co., Chicago, Ill.; Hooper, James Kimball, inspector and agent, New York Edison Co.; Hurlbert, Francis Wymond, foreign department, General Electric Co., 44 Broad St., New York City; Hyatt, Charles Edward, designing engineer, Crocker-Wheeler Co., Ampere, N. J.;

Kern, Oscar Frederick, station attendant, Mt. Whitney Power Co., Three Rivers, Cal.; King, Harry DeGolier, superintendent, Public Service Corporation of N. J.; Langan, John, salesman, Okonite Co., 253 Broadway, New York City; Lebenbaum, Paul, draftsman, Southern Pacific Co., San Francisco, Cal.; Lewinson, Leonard Julian, student, Columbia University, New York City; Lighthipe, William Wilson, superintendent, Marine Engine & Machine Co., 143 W. 24th St., New York; Macy, Oliver Crosby, electrician and engineer, New England Structural Co., 49 Morris St., Everett, Mass.; Marston, Anson, Dean of Division of Engineering, Iowa State College, Ames, Iowa; Marvin, Richard Hale, laboratory assistant, Edison General Electric Co., Bloomfield, N. J.; Mateer, Jesse Eugene, electrical engineer, Westinghouse Electric & Mfg. Co., Pittsburg, Pa.; McKee, William Norris, general manager, Moweaqua Electric Co., Mowequa, Ill.; Meygret, Achille, inventor, 238 W. 53d St., New York City; Moore, Harold Thompson, mechanical engineer, Dodge & Day, Nicetown, Pa.; Myers, Romaine Wright, expert electrician, United States Engineers, San Francisco, Cal.; Noble, Guy Hinchman, salesman, Stanley Electric Mfg. Co., Somerville, N. J.; Riddle, Jerry Bogs, superintendent, Ashburton Mining Co., Fair Oaks, Cal.; Robinson, Edwin Gardner, Jr., superintendent, Ballard Electric Co., Ballard, Wash.; Schick, Daniel Frederick, foreman, Philadelphia Electric Co.; Suhr, Otto Bruno, engineer in charge, Ontario Power Co., Niagara Falls, N. Y.; Tracy, Fred Glyndon, manager, C. G. Tracy & Co., Glyndon, Minn.; Van Cott, Lincoln, purchasing agent, Brooklyn Heights R. R. Co.; Ver Planck, William Everett, assistant engineer, General Electric Co., Lynn, Mass.; Wales, Samuel Sigourney, electrical engineer, Homestead Steel Works, Munhall, Pa.; Warren, Halbert B., chief engineer, Warren Electric Mfg. Co., Sandusky, O.; Whittlesey, William Augustus, treasurer and manager, Pittsfield Electric Co., Pittsfield, Mass.; Wright, Reuben Irving, assistant engineer, Electric Controller & Supply Co., Cleveland, O.; Yawger, Thomas H., assistant supt., Rochester Gas & Electric Co., Rochester.

Trade Notes.

THE SHAW ENGINEERING & MFG. COMPANY has opened an office at 15 Cortlandt Street, New York, for the purpose of taking care of its Metropolitan business.

THE REEVES ENGINE COMPANY has opened a branch office at 2220 Land Title Building, Philadelphia, which will be under the direction of Mr. W. E. S. Dyer.

AMERICAN STEAM PUMP COMPANY, Battle Creek, Mich., has issued section 2 of catalogue No. 12, devoted to its Marsh tank and vacuum pumps. These are illustrated and shown in their various styles, with data as to stroke, cylinders, piping, etc.

FALCON BRONZE COMPANY, Youngstown, Ohio, is manufacturer of every kind of bronze and brass castings for all varieties of machinery. It has issued a neat illustrated catalogue calling attention to its products and specialties of this character.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued a reprint of its catalogue No. 190,114, covering its R-type motor speed controllers. This catalogue shows the price of the 5-in, diameter R-type ceiling fan regulator to have been considerably reduced.

ELECTRICAL EQUIPMENT & SUPPLY COMPANY, 215½ Fourth Avenue, Pittsburg, has taken the exclusive representation in western Pennsylvania of the Gilmore Electric Company, of Boston, and the Electric Gas Lighting Company of the same city. It has also placed upon the market the "Esco" dry battery, the "Esco" wet battery, and the "Esco" soldering paste, all of which are meeting with gratifying success.

SLOTTING MACHINES.—The Newton Machine Tool Works, Inc., Philadelphia, recently issued catalogue No. 38, in which are illustrated a complete line of slotting machines, ranging from 6-in. to 96-in. stroke. The illustrations are very clear, and each is accompanied by a table giving the principal dimensions of the machine represented. Many of these slotters are shown to be operated by direct-connected electric motors.

THE KNOWLES STEAM WORKS, 114 Liberty St., New York City, are distributing Bulletin K-73 describing their recently designed "Express" pump. This pump is of the reciprocating type and is directly connected to an electric motor without gears or belts, and a 250-gallon pump runs at a speed of 300 r.p.m. In a test noted this pump showed an efficiency of 93 per cent. Pumps of this type are built in capacities of from 200 to 400 gallons per minute and for heads from 100 to 2000 feet.

TELEPHONE PROTECTORS.—Some of the many large exchanges which have been equipped with Frank B. Cook's No. 44 protector are the Citizens' Telephone Company, of Grand Rapids, Mich., equipped for 5425 paris; Home Telephone Company, of Dayton, equipped for 6000 pairs; North-eastern Telephone Company, of Portland, Me., 2500 pairs; the Home Telephone Company, of Kansas City, Mo., 2060 pairs in exchange A, 1440 pairs in exchange B, and 1640 pairs in exchange C; Utah Independent Telephone Company, of Salt Lake City, 4100 pairs.

THE S. M. JONES COMPANY, Toledo, Ohio, has issued a catalogue on its Acme gas and gasoline engines. Its Rathburn gas engine is particularly designed to run dynamos in smaller electric lighting plants, and is built in sizes of 25, 50, 80 and 125 horse-power. The gas consumption on natural gas is put at not to exceed 2 cubic feet per brake horse-power per hour, between maximum load and one-third load. The highest economy is at 20 per cent. less than rated load, at which point the gas consumption will not exceed 10 cubic feet per brake horse-power per hour.

FIVE-BAR TELEPHONE.—The Conn. Tel. & Elec. Company, of Meriden, Conn., has placed upon the market a new type of five-bar telephone which is equipped with its non-interfering ringing device. The inability to ring a subscriber when a receiver is off the hook, due to people listening on the same bridging line, limits the usefulness of the service and forms one of the greatest difficulties in heavily loaded rural lines. This company has overcome this difficulty and has issued a bulletin describing the same, which will be sent on request. The company has also issued its new and enlarged catalogue No. 8.

ALLEN SOLDERING STICKS.—The L. B. Allen Company, Inc., Chicago, received a letter from a member of the American Institute of Electrical Engineers, dated New York, July 15, 1904, which reads as follows: "I caled on the —. —. ——— Co., of this city, whose foreman made for me a very careful test of the Allen soldering stick. He was very enthusiastic about it, and it was not only tried on armature work in their shops, but also by their outside men in other construction work. He showed me several joints made by Allen sticks, and to use his expression, 'It is better in every respect than soldering solutions or acid, and less dangerous, especially in armature work, where drops of acid are likely to produce corrosion, and consequently short circuit.'"

WESTINGHOUSE COMPANY'S WORKS.—A departure from the usual trade literature is made in the handsome pamphlet recently issued by the Westinghouse Electric & Mfg. Company, on the industrial and sociological aspect of its works. It is an extremely interesting account of the company's growth and its modern equipment, and contains many fine half-tone illustrations of the main works at East Pittsburg and the various other branch works in different cities. Other illustrations show interior views and the works of the company. Among the many interesting views are those of huge generators in course of construction for the Manhattan and Subway railways in New York; St. Louis Exposition installations, Niagara Falls power equipment, etc. The company's employes reside at intermediate points between the city and the works, and for their accommodation six special railroad trains are run morning and evening. Two illustrations show an army of workmen on the station platform on their way to work and on their return home. It appears that recreation has not been overlooked, for there are shown views of the billiard room and bowling alley. There are also illustrations of the assembly hall of the Electric Club and an immense dining-room at the Casino for the employes. Altogether the work is of such character as to hold attention from the beginning to the end, and much can be learned from it as to the organization and operation of a large modern industrial enterprise. The pamphlet is beautifully gotten up, the illustrations being of excellent character, and the covers and pages handsomely ornamented in green and gold.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED JULY 19, 1904.

[Conducted by Rosenbaum & Stockbridge, Patent Att'ys, 140 Nassau St., N. Y.]

765,183. DOUBLE COMBINATION LOCAL SPRING JACK; James L. Kise, Wellington, Kan. App. filed Jan. 29, 1904. A simple device for telegraphers for cutting one sounder out and another of greater force in.

765,185. CONTROLLING APPARATUS FOR ELECTRICALLY-PROPELLED RAILWAY-VEHICLES; Benjamin G. Lamme, Pittsburg, Pa. App. filed Sept. 29, 1902. (See Current News and Notes.)

765,189. TRANSFORMER INSULATION; Odus B. Moore, Edgewood Park, Pa. App. filed Nov. 21, 1903. (See Current News and Notes.)

765,203. ALTERNATING-CURRENT ELECTRICAL APPARATUS; Charles F. Scott, Pittsburg, Pa. App. filed Sept. 13, 1902. (See Current News and Notes.)

765,206. BRUSH HOLDER; Robert Siegfried, Pittsburg, Pa., and Chester B. Mills, Wilkinsburg, Pa. App. filed Nov. 21, 1903. Structural details of a brush holder of the parallel-motion type.

765,207. BRUSH HOLDER FOR ELECTRICAL MACHINES; Robert Siegfried, Pittsburg, Pa. App. filed Nov. 21, 1903. See preceding patent.

765,209. METHOD OF OPERATING AND CONTROLLING ELECTRIC MOTORS; Norman W. Storer, Pittsburg, Pa. App. filed Aug. 15, 1902. Refers to motor control for electric automobiles. The motor has an insulated field magnetic circuit and the method of effecting speed acceleration consists in first supplying energy from a secondary battery having its cells connected in parallel to the motor field magnet and armature coils in series, then connecting one-half of the field magnet coils in parallel with the other half and then changing both the battery cells and the field magnet coils to series relation.

765,212. ELECTROMAGNETIC BLOCK SYSTEM OF CONTROL; Guion Thompson, Duluth, Minn. App. filed March 17, 1902. Provides an arrangement of co-acting electromagnetic devices located on a moving car and along the roadway which will operate a signal on the car under certain conditions.

765,216. TROLLEY GUARD; William C. Washburn, Cincinnati, Ohio. App. filed Feb. 24, 1904. An arrangement of guards to prevent the accidental disengagement of the wheel from the feed wire.

765,228. COIL RETAINING MEANS FOR ELECTRICAL MACHINES; Isaac De Kaiser, Wilkinsburg, Pa. App. filed Nov. 21, 1903. Structural details.

765,236. CONTROLLER FOR ELECTRICAL TRANSFORMERS; Georges E. Gaiffe, Paris, France. App. filed April 4, 1902. An economizing apparatus comprising a principal and an auxiliary transformer having their primary coils in series and connected with the mains and their secondary coils also in series and connected with the consumer's circuit, and means for cutting in and out the auxiliary transformer, controlled from the conditions in the consumer's circuit, the said means short-circuiting the secondary circuit of the auxiliary transformer before the primary circuit thereof.

765,255. SERVICE METER FOR TELEPHONE EXCHANGES; Charles E. Scribner, Chicago, Ill. App. filed March 15, 1904. Relates to a service meter for telephone exchanges and has for its object to provide an im-

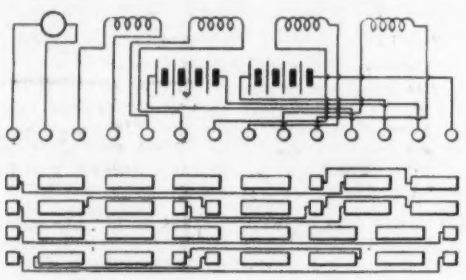
proved connection counter or registering device and circuits therefor whereby each use of the telephone may be registered and charge made accordingly.

765,263. ELECTRO FLUID PRESSURE SWITCHING MECHANISM; Walter J. Bell, Los Angeles, Cal. App. filed July 25, 1903. An improvement on a former patent, the invention residing in the use of a solenoid magnet for the operation of the compressor instead of an electric motor.

765,264. RAILWAY CROSSING SIGNAL; Walter J. Bell, Los Angeles, Cal. App. filed July 28, 1903. A right-of-way signaling appliance for railway crossings, comprising a plurality of electric lights each arranged to project light-rays in a direction different from the others, and a group of separately-manipulated circuit closers in the light connections.

765,266. AUDIBLE SIGNALING DEVICE; Walter J. Bell, Los Angeles, Cal. App. filed Jan. 5, 1904. An electro-magnetically operated bell designed to be employed in connection with a railway barrier or gate.

765,298. METHOD OF SIGNALING; Richard W. Shoemaker and Lawson H. Giddings, Pasadena, Cal. App. filed June 25, 1902. The method consists of propagating waves utilized in wireless telegraphy and defining each wave by energizing the primary of the induction coil with an initial



765,209.—Method of Operating and Controlling Electric Motors.

electrical impulse of relatively high tension and then an electrical impulse of a lower tension.

765,311. SIGNAL SYSTEM; Samuel Friedman, New York, N. Y. App. filed June 23, 1902. Safety system for tunnels, etc. Trolleys on the locomotive engage with gangs of wires strung along the track and serve to transmit signals through similar trolleys carried by a succeeding or preceding locomotive.

765,329. BLOCK SIGNAL SYSTEM FOR RAILWAYS; Richard Tomlinson, Brooklyn, N. Y. App. filed Nov. 30, 1903. Details. Improvements on a former patent.

765,348. ELECTRIC ELEVATOR; Ernest H. Vogel, New York, N. Y. App. filed Nov. 16, 1903. The invention consists, essentially, in a relatively large screw-drum actuated internally by a motor and mechanism supported on the car or platform, the screw thread or way being formed upon the periphery of the drum.

765,370. INSULATED RAIL JOINT; George A. Weber, New York, N. Y. App. filed Dec. 28, 1903. Details.

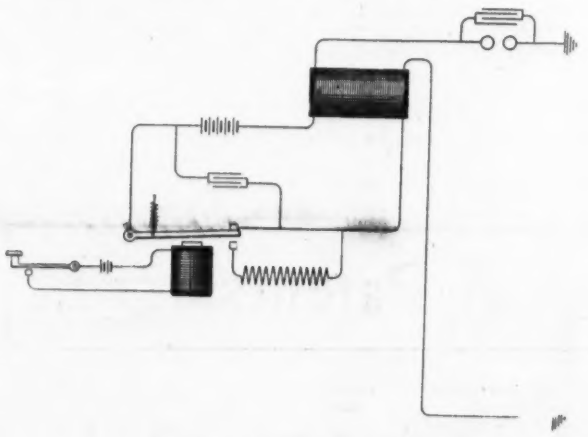
765,371. PROCESS OF NICKEL-PLATING; Jonas W. Aylsworth, East Orange, N. J. App. filed Sept. 15, 1903.

765,380. RAILROAD SAFETY APPLIANCE; James H. Finley, Norristown, Pa. App. filed July 7, 1903. Electrical devices for stopping a train when it runs past a danger signal and to operate alarms and an indicator for the purpose of making a permanent record of each failure to observe a signal.

765,383. ELECTRIC SECONDARY CLOCK; Fred I. Getty, Chicago, Ill. App. filed Dec. 2, 1901. Relates to clocks which depend for their actuation upon a main or master clock connected up in circuit therewith. Dispenses with springs, the clock being driven by parts moved solely by gravity.

765,386. AUTOMATIC FIRE ALARM SYSTEM; John C. Howe, Indianapolis, Ind. App. filed April 13, 1903. For hotels and the like. Provides for sending alarm of fire from one part of the building to a central station from which alarms will be automatically sent out to various other rooms or parts of the building.

765,413. SELECTIVE SIGNALING APPARATUS; John J. Comer, Park-



765,298.—Method of Signaling.

ridge, Ill. App. filed May 22, 1901. Relates to telephone exchange systems, and provides means whereby sub-stations of a party line may be signaled without operating the signal devices of the other stations.

765,435. ALARM DEVICE; George M. Mayer, Chicago, Ill. App. filed Dec. 15, 1902. Comprises two electro-magnets, one in a closed circuit and the other in a normally open circuit, an alarm device in a third circuit and a circuit controlling device controlled by said magnets, adapted when the normally open circuit is closed to open the closed circuit and close the alarm circuit.

765,441. DEVICE FOR USE WITH TELAUTOGRAPHS; Foster Ritchie, Hampstead, England. App. filed Jan. 3, 1902. Details of an instrument adapted to be used with a telautograph apparatus for adjusting and indicating the resistance of the external circuits.

765,449. TROLLEY HARP; Earl R. Warren, Holyoke, Mass. App. filed March 7, 1904. Aims to produce a harp or yoke by which the removal and replacement of the trolley wheel may be effected with unusual facility.

765,457. PAGE PRINTING TELEGRAPH; Charles L. Buckingham, New York, and Emil Germann, Brooklyn, N. Y. App. filed Aug. 25, 1902. Provides means whereby printing may be caused to begin at the extreme left or at any point across the page as desired by the printing attendant.

765,460. MOTOR-CONTROLLER; Henry H. Cutler, Milwaukee, Wis. App. filed Jan. 30, 1901. (See Current News and Notes.)

765,461. SELECTIVE SIGNALING SYSTEM; William M. Davis, Chicago, Ill. App. filed March 27, 1903. A "party line" system in which the signaling devices are designed so as to respond only to a current of a peculiar nature. In a group of three signaling devices, one would respond to alternating currents, another to direct positive and another to direct negative.

765,465. METHOD OF STARTING GAS OR VAPOR ELECTRIC DEVICES; Stanwood E. Flichtner, Englewood, N. J. App. filed Aug. 10, 1903.

765,466. STARTING SYSTEM FOR GAS OR VAPOR ELECTRIC DEVICES; Stanwood E. Flichtner, Englewood, N. J. App. filed Aug. 10, 1903.

765,469. SHADE FOR X-RAY TUBES; Robert Friedlander, Chicago, Ill. App. filed Sept. 19, 1903. A shield for ray-tubes, comprising a supporting body portion of paper-pulp or the like, and a series of coatings of a paint-like non-conducting composition opaque to X and like rays.

765,470. ELECTRIC THERAPEUTIC APPARATUS; Robert Friedlander, Chicago, Ill. App. filed June 6, 1904. A chair or seat comprising a series of vacuum tubes connected up with a source of high frequency current.

765,480. BATTERY TRANSMITTER; Rasmus Hansen, Chicago, Ill. App. filed June 23, 1902. Structural details.

765,488. TELEPHONE TRANSMITTER; William Kaisling, Chicago, Ill. App. filed April 17, 1903. Structural details.

765,489. PLUG SEAT SWITCH FOR TELEPHONE SWITCHBOARDS; William Kaisling, Chicago, Ill. App, filed Nov. 23, 1903. Details aiming to insure positive action and efficiency of operation.

765,516. TROLLEY; Wilson Selakosky, Lehighton, Pa. App. filed Jan. 27, 1904. Carries an arrangement of angularly disposed disks to prevent trolley wheel slipping from wire.

765,530. MEDICAL BATTERY; George Francis Webb, Geneva, Ohio. App. filed May 3, 1904.

765,544. TROLLEY HEAD; Stanislas Bourgeois, Manchester, N. H. App. filed Oct. 24, 1903. Has a U-shaped guard which embraces the lower half of the trolley wheel and prevents the wheel from engaging with the upper part of the feed wire when displaced.

765,550. ELECTRIMAGNET; Walter W. Brown, Schenectady, N. Y. App. filed April 23, 1904. Aims to avoid waste of current by providing means whereby the current is automatically cut down after the signal has been set, a small current sufficing to hold the signal in position.

765,592. ELECTRIC METER; Albert Peloux, Geneva, Switzerland. App. filed Oct. 16, 1902. Improvements on a former patent which aim to reduce the friction between commutators and brushes.

765,609. CARBON BREAK SWITCH; Charles C. Badeau, Schenectady, N. Y. App. filed Sept. 16, 1901. A switch having an auxiliary carbon contact device to relieve the main contacts from effects of arcing.

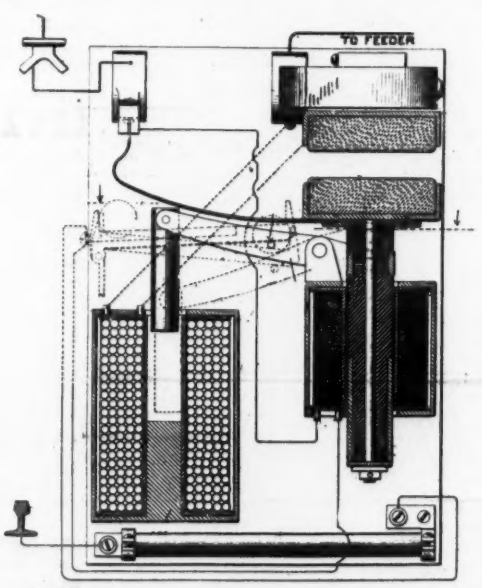
765,612. SAFETY DEVICE; Fred B. Corey, Schenectady, N. Y. App. filed Jan. 2, 1904. Consists of means, such as a pneumatically-actuated relay, operatively connected to the train pipe of an air-brake system and arranged to control the supply of power to the operating means for the motor-controller in a system of control employing master and motor controllers.

765,617. STARTING MEANS FOR GAS OR VAPOR ELECTRIC DEVICES; Stanwood E. Flichtner, Englewood, N. J. App. filed Sept. 19, 1903.

765,625. SOCKET FOR INCANDESCENT LAMPS; Norman Marshall, Newton, Mass. App. filed Jan. 16, 1901. Comprises a body portion supporting the current carrying parts, a metallic shell surrounding the body, an insulating sleeve secured to the body and means for obtaining access to the terminals without removing the insulating sleeve.

765,653. ELECTRICAL SWITCH OPERATED BY ELECTROMAGNETS; William Grunow, Jr., Bridgeport, Conn. App. filed Feb. 7, 1902. Apparatus—see following patent.

765,654. ART OF CONTROLLING ELECTRICAL SWITCHES OPERATED BY ELECTROMAGNETS; William Grunow, Jr., Bridgeport, Conn. App. filed Aug. 2, 1902. The method of effecting circuit connection between a source of electrical energy and a translating device without damaging arcing, consisting in utilizing a part of the current to primarily close the working circuit; then utilizing the working current to maintain the work-



765,654.—Art of Controlling Electrical Switches Operated by Electromagnets.

ing circuit firmly closed and finally interrupting the flow of the first-named current after a definite time interval by the application of a retarded force.

765,655. ELECTRICAL SWITCH OPERATED BY ELECTROMAGNETS; William Grunow, Jr., Bridgeport, Conn. App. filed Aug. 2, 1902. Apparatus—see preceding patent.

12,240. INDIVIDUAL TELEPHONE SWITCH AND LOCK-OUT MECHANISM FOR INTERCONNECTING LINES; Albert K. Andriano, San Francisco, Cal., and Hermann Herbstritt, New York, N. Y. App. filed June 15, 1904. Provides for certain switching devices to prevent parties at two connected stations from being overheard or interrupted by a third party.

12,241. CONTROLLER FOR ELECTRIC MOTORS; William B. Potter, Schenectady, N. Y. App. filed June 21, 1904. (See Current News and Notes.)

12,242. BRUSH HOLDER; Edward D. Priest, Schenectady, N. Y. App. filed May 15, 1901. Relates to the construction of brush holders which are to be inclosed within the frames of electric railway motors.

12,243. MEANS FOR INSULATING ELECTRICAL APPARATUS; Edward D. Priest, Schenectady, N. Y. App. filed Feb. 20, 1903. Relates to means for supporting and insulating.